<u>EXHIBIT 5</u>

Extract of Casmalia Resources Superfund Site Final Remedial Investigation Report dated January 25, 2011

Casmalia Resources Superfund Site

Final Remedial Investigation Report

Prepared for:

USEPA, Region 9
75 Hawthorne Street
San Francisco, CA 94105

Prepared by:

Casmalia Resources Site Steering Committee

CASMALIA SITE REMEDIATION PROJECT

Corey Bertelsen
Project Manager

January 25, 2011

To: Russell Mechem – EPA
Mark Samolis - EPA

Subject: Final Remedial Investigation Report

The Casmalia Resources Site Steering Committee (CSC) has prepared this Final Remedial Investigation (RI) Report as required by Section 11.6 of the EPA approved Remedial Investigation/ Feasibility Study (RI/FS) Work Plan (CSC, 2004) that summarizes the investigation and remedial activities undertaken for the former Casmalia Hazardous Waste Management Facility (Site). The CSC previously provided EPA a draft final RI Report dated January 30, 2010.

The Final RI Report is organized in the same fashion as the previous draft final report and complies with the requirements of Section 11.6 of the RI/FS Work Plan which meets EPA's guidance documents regarding RI Reports. The RI Report addresses EPA's comments dated June 16, 2010 on the previous draft final report. The CSC and EPA have spent considerable time discussing those comments and agreeing on how we would incorporate them into the revised report. We believe that we have done that consistent with those discussions.

The CSC has distributed copies of the Final RI Report to the distribution list below, which is the same as the draft Final RI Report distribution. The CSC sent complete hard copies of the document to all of those who received hard copies of the draft final report and the remainder of the distribution list is receiving a complete electronic copy (text, tables and figures).

We look forward to your review and approval of the submittal.

Regards,

Corey Bertelsen
Casmalia Project Coordinator

For the purposes of this RI Report, the Site area is defined as the approximate 252 acres encompassed within Zone 1, as defined above. Throughout the remainder of this report, those areas lying outside the limits of Zone 1 are referred to as being "off-site."

The physical features of the site, including site boundaries, topography, climate, hydrology, geology/hydrogeology, land use, demography, and wildlife habitats, are described in Section 4.0. Section 4.0 has also been updated with the most recent information available, including data developed during the Remedial Investigation.

2.2 Site History and Use

The Site is a former hazardous waste management facility that Casmalia Resources began operating in 1972 in accordance with California Regional Water Quality Control Board (CRWQCB) Waste Discharge Permit No. 72-28. The original CRWQCB waste discharge permit allowed a 61-acre hazardous waste disposal facility including 15 surface impoundments and one landfill area. The waste discharge permit was amended twice, once in 1976 to allow for a 118-acre expansion of the facility to the east and north (Permit No. 75-73), and again in 1980 (Permit No. 80-43) expanding the facility approximately 73 acres toward the west, bringing the facility to its present size of 252 acres (McClelland Consultants, 1989). The current and historical site layouts are shown on Figure 2-3 and Figure 2-4, respectively. A historical timeline of site development and related milestone events are presented in Figure 2-5.

Casmalia Resources ceased accepting off-site liquid wastes in July 1987 and stopped accepting off-site solid waste in November 1989. Casmalia Resources completed pond closure activities in the period from 1989 to 1991 while they awaited approval to modify the Site waste treatment and disposal methods and facilities. After being denied the necessary operating permits to continue waste disposal activities, Casmalia Resources suspended all site activities in 1991, with the exception of extracting liquids from the perimeter control trenches (PCTs). During the 1991 timeframe, Casmalia Resources also developed groundwater monitoring work plans and landfill closure and post-closure plans. From 1992 through 1996, the USEPA maintained the Site. The CSC took over site activities in 1996, and has been responsible for various site investigation and closure projects from that time through the present. Detailed information related to the permits obtained and orders issued by the agencies during site operations is presented in Table 2-1, Permit History Information.

Casmalia Resources accepted the full range of listed and characteristic RCRA wastes as specified in Subparts C and D of 40 Code of Federal Regulations (CFR) 261 (A.T. Kearney/SAIC, 1987). Wastes received at the Site included (in part): petroleum wastes, acids, bases, organic chemical solvents, petroleum solvents, paint sludge, pesticides, infectious wastes, septic tank pumpings, and sewage sludge. Section 3.0 of the April 1988 RCRA Part B permit application (Woodward Clyde Consultants, 1988b) includes a complete list of wastes accepted at the facility by landfill and treatment units. Waste disposal units at the Site included:

- 6 landfills;
- 43 surface impoundments;
- 15 evaporation pads;
- 2 non-hazardous waste spreading areas;
- 6 oil field waste spreading areas;
- 11 shallow injection wells;
- 7 disposal trenches; and

- 1 drum burial unit.

Note that although contaminated liquids were eventually transferred to most site ponds, only a few of the site ponds directly received off-site wastes. The Site also had five waste treatment units: an acid/alkaline neutralization facility, a hydrogen peroxide treatment unit, oil recovery and treatment tanks, a wet air oxidation unit, and a temporary pilot-scale powder-activated carbon treatment (PACT) unit.

Surface impoundments (used for evaporation and treatment of liquid wastes or for storing stormwater), and disposal pads (used to evaporate liquid wastes and site stormwater runoff) primarily occupied the southern and central portions of the Site, whereas the six landfill disposal areas were positioned along the northern and northeastern margins of the Site. A few of the surface impoundments and evaporation pads were also present in some areas of the northern portion of the Site between the major landfill cells (Figure 2-4). The variety of former and existing waste management units at the Site are more fully described in the following sections.

2.2.1 Site Operational Information

Numerous prior studies have been completed at the Site and surrounding area since operations began, including those conducted in support of facility siting and design, regulatory permitting and compliance, waste characterization, and soil and groundwater investigations. The information presented in this section has been compiled and summarized primarily from technical reports previously prepared by others, and these reference documents are listed in Section 2.2 of the Work Plan. The reader is referred to these original source documents for a more detailed treatment of the topics summarized herein.

Parties sending wastes to the Casmalia Site were required to prescreen or profile their wastes before shipping waste to the Site. As part of their waste confirmation program, Casmalia Resources randomly tested approximately 10 to 20 percent of the incoming wastes. The waste pre-screening and confirmation testing programs employed at the Site are more fully described in the Final Environmental Impact Report for the facility (McClelland, 1989).

Casmalia Resources personnel directed haulers with drummed wastes to the drum handling facility south of the Pesticides/Solvents Landfill. Drummed wastes were placed on the loading dock where Casmalia Resources personnel compared the drum labels with the manifests and collected samples of any wastes that were visually inconsistent with the waste profile. Casmalia Resources then transported drummed wastes to the various landfills for final disposal.

Haulers with bulk solid or liquid wastes were directed to a specific landfill, pond, or treatment system, depending on the waste characteristics. Casmalia Resources generally segregated incoming waste by primary type, and the wastes were handled in specific locations of the Site based on whether they were acidic, caustic, oily, solvent-based, etc.

Before leaving the Site, empty trucks washed out their tanks and/or bins at the wash-out facilities located at Ponds D and 16.

2.2.2 Site History Review

In preparing the Work Plan, the CSC reviewed available historical documents and aerial photographs, selected site topographic maps, and interviewed agency personnel. The CSC

also met with former site operations personnel who worked on the Site from the mid and late 1970s through the present to collect additional historical and anecdotal information that may be relevant to remedial planning. Key historical documents reviewed in preparation of the Work Plan included the *RCRA Facility Assessment* (A.T. Kearney/SAIC, 1987), *Environmental Impact Report (EIR) for the Casmalia Resources Class I Hazardous Waste Disposal Site Modernization Plan* (McClelland Consultants, 1989), and the *RCRA Part B Permit Application* (Woodward Clyde Consultants, 1988b).

2.2.2.1 Aerial Photograph Review

In preparing the Work Plan, the CSC conducted a review of available historical aerial photographs of the Site for the time period 1956 through 2002. A complete listing of the photographs examined and the detailed findings of this review are presented in Appendix J of the Work Plan; the salient findings of this review are summarized below. Select photographs depicting the sequential development and closure of the Site are presented in Figure 2-10.

The Site was used for agricultural purposes prior to 1970. The initial site development was first apparent on the 1974 aerial photograph with several oil-field-related surface impoundments situated in the center of the site. Grading and continued surface impoundment expansion is noted in the 1979 and 1980 photographs. Some of the injection wells and disposal trenches were observed in the 1979 and 1980 photos. Waste disposal in the landfills was also noted in these photographs, as were the oil recovery tanks associated with the oil field waste ponds in the center of the site.

By 1983, the A-series ponds had been developed and the RCRA Canyon Area development was evident. Also by this time, the spreading and sludge drying areas appeared to be active. A spray evaporation area in the southwestern portion of RCRA Canyon also was noted only in this photograph (and not in the 1982 or 1984 photographs). Some of the evaporation pads between the landfills also appeared to be active in the 1983 photograph. The building that was initially used for the Zimpro wet air oxidation system and the four associated tanks are shown on the 1983 photograph.

In the 1985/1986 time period, spreading in the RCRA Canyon Area was notably active and a new pond was evident in the Burial Trench Area. Surface impoundment operations and waste disposal in the landfills continued.

By 1988, the surface impoundments were observed to be empty and the site appeared drastically different as a result of the large amount of excavation and grading undertaken for pond closure. Filling in the landfills and using the pads between the landfills continued. The new Administration Building was observed in the 1988 photograph.

In the 2002 photograph, the stormwater ponds and treated liquids impoundments are observed and the Pesticides/Solvents and Heavy Metals/Sludges Landfills are capped; grading in the Caustics/Cyanides Landfill in preparation for capping is evident. By 2003, the Caustics/Cyanides and Acids Landfills are capped.

2.2.2.2 Topographic Map Review

In preparing the Work Plan, the CSC collected selected historical topographic maps of the Site for the time period to help define former surface drainage features, ponds and pads, liquids

treatment facilities, site roads, and site support facilities. Maps from the time period 1956 through 1998 were reviewed, with those from the years 1956 (pre-development), 1982 and 1987 (operational period) providing the most relevant information for documenting historical site features. Relevant historical site features were identified and digitized onto base maps of the site, and used to help plan the remedial investigation and sampling activities. Comparison of site topography between 1987 and 1998 demonstrates the nature and magnitude of cut and fill earthwork that was conducted across the Site during earlier impoundment closure activities. The 1998 site topography is essentially the current topography, with the exception of grades in the capped landfill areas and a portion of the north ridge area. A complete listing of the maps examined, scanned copies of the individual maps, and a discussion of the findings of this review are presented in Appendix L of the Work Plan.

2.2.2.3 Agency Personnel Interviews

In preparing the Work Plan, the CSC met with agency personnel who had involvement in prior site investigations, possessed personal knowledge of historical site operations and facilities, and/or were involved in emergency response actions during the 1992 to 1996 timeframe. Individuals interviewed included select staff from the RWQCB, Department of Toxic Substances Control (DTSC) and EPA. These agency personnel interviews were used to gather additional relevant information regarding pond closure activities, and truth information gleaned from the aerial photograph and topographic map review. Results of these interviews are documented in Appendix M of the Work Plan.

2.2.3 Facilities

2.2.3.1 Waste Management Units

Casmalia Resources operated several waste management units at the Site including:

- 5 existing landfills, including the PCBs, Pesticides/Solvents (P/S), Heavy Metals, Caustics/Cyanides and Acids Landfills;
- Former RCRA Landfill;
- Former surface impoundments, including 43 liquid storage ponds and 15 evaporation pads;
- 2 non-hazardous waste spreading areas known as Sludges 1 and 2;
- 6 oil-field waste spreading areas;
- Burial Cells Unit (or Burial Trench Area), including 11 shallow disposal wells and 7 disposal trenches; and
- Former drum burial unit.

The locations of the waste management units and treatment facilities are illustrated on Figure 2-4, Historical Site Layout. As part of the review of historical documents and photographs, the CSC prepared a summary table indicating the observed status of each waste management unit and treatment facility at the site. Table 2-2 chronicles the development status of each unit from 1973 through 2002, and indicates whether a particular area was being excavated (or developed), whether there is waste present in the disposal units during those years, and notes the years in which remediation or closure activities are evident. The CSC also notes areas where grading takes place and whether a particular area appears vegetated during that year's photo. The information gleaned from the photo review was used to ground-truth some of the

written records of site operations presented in the sections below. The nature of these various waste management units is generally described below.

Note that although some site closure activities were performed at the Site, the sections below concentrate primarily on activities relevant to the operational years. The closure activities and response actions conducted at the Site are later summarized in Section 2.2.5.

2.2.3.1.1 Existing Inactive Landfills

Each landfill was constructed within individual natural canyons incised into native soils and claystone bedrock of the Todos Santos Member of the Sisquoc Formation. The landfills were constructed prior to promulgation of the prescriptive regulatory requirements of Section 40 of the Code of Federal Regulations (CFR), Part 264 of the Hazardous and Solid Waste Amendments (HSWA) to RCRA. Therefore, man-made liners and leachate collection systems were not installed beneath the landfills. As described below, the landfills were generally started at the south end of a canyon and native materials were excavated to bedrock (i.e., the unweathered claystone) to form the base of the landfills. Wastes were then placed at the base of the landfills and excavated native materials were placed over the wastes as cover.

In accordance with the closure plans prepared for the inactive landfills, Casmalia Resources constructed clay buttresses at the toes of the landfills, as necessary, to improve stability. The buttresses soil materials were taken from the former Pond 11, and former Pads 10B, 10C, 10F, and 10G, and Sludges 1 areas after those areas had been closed. With the exception of the PCB Landfill, Casmalia Resources also graded the landfills in accordance with the closure plans then prepared for each landfill. To achieve the desired grades, Casmalia Resources placed approximately 20 to 60 feet of stabilized soils excavated as part of the pond and pad closure activities. Wastes immediately below the surface of the Caustics/Cyanides Landfill were encountered while the CSC capped that landfill in 2001, indicating that wastes may have been placed in the stabilized soil layer during Casmalia Resources' closure period. Casmalia Resources placed a minimal thickness of cover soil over the PCB Landfill because this landfill was never filled to capacity.

The CSC improved the P/S Landfill buttress in 1998 and constructed a RCRA cap over that landfill during the 1999 construction season. Corrective action activities for the P/S Landfill were completed by the CSC in 2001. The CSC constructed the portion of the Engineering Evaluation/Cost Analysis (EE/CA) Area RCRA cap over the Heavy Metals Landfill and the interstitial areas on either side of that landfill during the 2001 construction season. The CSC capped the remainder of the EE/CA Area (including the Caustics/Cyanides and Acids Landfills along with the interstitial areas) during the 2002 construction season. The CSC constructed a buttress for the Caustics/Cyanides Landfill as part of the EE/CA Area capping project.

<u>PCB Landfill</u>

The PCB Landfill is located in the northern area of the Site between the Former RCRA Landfill and the Pesticides/Solvents Landfill. A portion of the area was first operated as a trench fill but Casmalia Resources changed filling techniques to an area fill method (A.T. Kearney / SAIC, 1987). The PCB Landfill was used for the disposal of non-liquid PCB-contaminated materials, such as drained electrical transformers, soil, rags, and other debris (Section 3.5.2.2, Page 3-22, McClelland Consultants, 1989). A total estimated 390,400 cubic yards of waste and soil cover at a ratio of 2.7:1 waste to soil cover were deposited in the PCB Landfill. The PCB Landfill

operated under a TSCA permit issued by USEPA in November 1978, and permits to expand this landfill were issued by USEPA in 1979 and again in 1980. The original size of PCB landfill was 5.46 acres but only 2.83 acres were useable due to terrain. An additional 14.08 acres approved for use by USEPA in 1981, bringing the total acreage of the landfill up to 20.54 acres, however Casmalia Resources never used the additional fill area (A.T. Kearney / SAIC, 1987). Waste disposal operations at the PCB Landfill were discontinued in April of 1986 (Section 3.5.2.2, Page 3-22, McClelland Consultants, 1989). As further discussed in Section 2.2.3.2, a compacted clay barrier was installed below the toe area of the PCB Landfill in 1980 to limit lateral subsurface fluid migration from the disposal cell. Soil cuttings generated during remedial investigation activities were placed into the PCB landfill for disposal.

Pesticides/Solvents Landfill

The Pesticides/Solvents Landfill (also historically referred to as the Solvent/Pesticide Landfill) is located in the north-central portion of the Site between the PCB Landfill and the Heavy Metals Landfill. The P/S Landfill began receiving waste during September 1979. Wastes were placed in an approximate 10.6-acre portion of the now capped 13.5-acre landfill area. The P/S Landfill was developed in an existing canyon and fill placement began at the toe of the landfill and wastes were place to the north as filling operations continued. The landfill was developed by cut-and-fill methods with excavations extending into the unweathered gray claystone. As additional lifts of waste were introduced, more excavation was performed at the head of the existing canyon, with removed native materials being used as daily and interim cover. Casmalia Resources also used oil field drilling muds as daily cover when available.

Solid and liquid wastes placed into the P/S Landfill included organic solvents, paint, pesticides, asbestos, and infectious waste (Section 3.4.1.1, Page 3-6, McClelland Consultants, 1989). A full list of waste by USEPA waste code that was placed in the landfill is found in Table 3-5 (i) of the site Part B permit application of 1988 (Woodward-Clyde Consultants, 1988b). By January of 1989, an estimated 899,000 cubic yards of waste, 527,990 cubic yards of daily soil cover, and 91,460 cubic yards of pond closure soils (for a total of 1,518,450 cubic yards of waste and soil cover) were deposited in the landfill. The P/S Landfill also includes the oil field waste Spreading Area S-4.

Based on a 1998 topographic map, an unknown volume of additional waste and soil waste was placed in the landfill after January of 1989 (Figure 3-2 of Foster Wheeler / GeoSyntec, 1999). Waste disposal activities in the currently capped P/S Landfill are believed to have ceased when former surface impoundment closure activities were discontinued in late 1990. As further discussed in Section 2.2.3.2, a compacted clay environmental barrier and fluid collection and extraction gallery were installed below the toe area of the P/S Landfill in 1980 to limit fluid migration from the disposal cell below.

Heavy Metals Landfill

The Heavy Metals Landfill (also historically referred to as the Heavy Metals/Sludges Landfill) is located in the northeastern portion of the Site between the P/S Landfill and the Caustics/Cyanides Landfill. Wastes were placed in an approximate 5.4-acre area of the currently capped 10.3-acre Heavy Metals Landfill. The Heavy Metals Landfill started receiving waste during November 1979. Construction of the Heavy Metals Landfill commenced with an approximate 20-foot-deep excavation just below the juncture of two small canyons. As lifts of waste were added, the working face was extended up the small canyons with some

subexcavation preceding waste placement. The natural ridge between the two canyons was eventually removed during this process and utilized as interim cover material.

Materials placed in the Heavy Metals Landfill included solidified bulk or containerized wastes containing heavy metals, sludges, empty plastic and metal drums, drilling fluids, and oil field wastes (Section 3.4.1.2, Page 3-6, McClelland Consultants, 1989). The Heavy Metals Landfill also included dried drilling mud and unspecified oil-field waste from Spreading Area S-3. A full list of waste by USEPA waste code that was placed in the landfill is found in Table 3-5 (h) of the site Part B permit application of 1988 (Woodward Clyde Consultants, 1988b). By January 1989, an estimated 230,090 cubic yards of waste, 135,130 cubic yards of daily soil cover, and 233,870 cubic yards of pond closure soils (for a total 599,090 cubic yards of waste and soil cover) were deposited in the Heavy Metals Landfill. Comparison of cross-sectional maps of the landfill for March 1989 and January 1998 identify that an unknown volume of additional waste and soil waste was placed in the landfill after January of 1989 (Figures B3 and B4 of Foster Wheeler / GeoSyntec, 1999). Waste disposal activities in the landfill are believed to have ceased when former surface impoundment closure activities were discontinued in late 1990. In March 1988, liquids were encountered at the Heavy Metals Landfill toe during a landfill drilling program conducted to assess the presence of liquids in the landfills.

Caustics/Cyanides Landfill

The Caustics/Cyanides Landfill is located in the northeast corner of the Site between the Heavy Metals Landfill and the Acids Landfill. Wastes were placed in an approximate 4.5-acre area of the currently capped 7-acre landfill. The landfill started receiving waste during July 1979. This landfill was initiated with only minimal excavation at the southwest end of a small canyon. As lifts were added, the working area was expanded up the canyon toward the northeast. The disposal unit was later expanded toward the east as the canyon side and a small ridge were excavated and used as interim cover.

Waste materials placed into the Caustics/Cyanides Landfill included solidified bulk and containerized wastes containing caustics, cyanides, and sulfides. The Caustics/Cyanides Landfill also includes dried drilling mud and unspecified oil field waste from Spreading Area S-2. A full list of waste by USEPA waste code that was placed in the landfill is found in Table 3-5 (g) of the site Part B permit application of 1988 (Woodward Clyde Consultants, 1988b). Dried drilling muds and oil-field wastes were also disposed of in this landfill (Section 3.4.1.3, Page 3-6, McClelland Consultants, 1989). By January 1989, an estimated 273,940 cubic yards of waste, 160,880 cubic yard of daily soil cover, and 318,850 cubic yards of pond closure soils (for a total 753,670 cubic yards of waste and soil cover) had been deposited in the landfill. Comparison of cross-sectional maps of the landfill of March 1989 and January 1998 identify that an unknown volume of additional waste and soil waste was placed in the landfill after January of 1989 (Figure B5 of Foster Wheeler / GeoSyntec, 1999). Waste disposal activities in the landfill are believed to have ceased when former surface impoundment closure activities were discontinued in late 1990. In March 1988, liquids were encountered at the Caustics/Cyanides Landfill toe during a landfill drilling program conducted to assess the presence of liquids in the landfills. The Caustics/Cyanides Landfill includes a clay buttress constructed to stabilize waste and control fluid migration.

Acids Landfill

The 5.4-acre Acids Landfill is located along the eastern site boundary south of the Caustics/Cyanides Landfill. The landfill started receiving waste during July 1979. The Acids Landfill was initiated at the west end of a small canyon as a narrow excavation less than 20 feet deep just east of the haul road. As lifts were added, more material was excavated from the base and sides of the small canyon.

Waste materials placed into this landfill included solidified or bulk containerized acidic wastes. A full list of waste by USEPA waste code that was placed in the landfill is found in Table 3-5 (f) of the site Part B permit application of 1988 (Woodward Clyde Consultants, 1988b). By January 1989, an estimated 35,930 cubic yards of acid solid waste, 51,270 cubic yards of daily soil cover, and 138,570 cubic yards of pond closure soils (for a total of 225,770 cubic yards of acid solid waste and soil cover) were deposited in the landfill. Comparison of cross-sectional maps of the landfill of March 1989 and January 1998 identify that an unknown volume of additional waste and soil waste was placed in the landfill after January of 1989 (Figure B6 of Foster Wheeler / GeoSyntec, 1999). Waste disposal activities in the currently capped landfill are believed to have ceased when former surface impoundment closure activities were discontinued in late 1990. In March 1988, no liquids were encountered at the landfill toe during a drilling program conducted to assess the presence of liquids in the landfills.

2.2.3.1.2 Burial Trenches and Shallow Disposal Wells

Waste disposal at the Site began in the early 1970s with disposal in seven trenches directly south of the PCB Landfill and directly west of the P/S Landfill. Waste disposal in that area (referred to as the Burial Cells Unit, or Burial Trench Area) also included disposal in shallow wells in the mid to late 1970s and early 1980s. Although records do not go back far enough to indicate the dates of use and type of waste placed in Trench 1, Trenches 2 through 7 operated from August 1974 to October 1979 (A.T. Kearney / SAIC, 1987). The disposal trenches were constructed by excavating a series of cells 15 to 40 feet square and approximately 15 feet deep. Cells were constructed in seven rows and assigned numerical designations, with the individual cells in a given row being assigned an alphabetical designation.

Wastes deposited into the trenches consisted of a wide variety of bulk and containerized liquids and sludges, with the exception of Trench 6, which accepted only PCB wastes. Wastes disposed in the remaining trenches included acid and alkaline sludges, paint sludges, waste paints, waste solvents, oil, metal hydroxides, asbestos, empty pesticide containers, pesticides, iron sponge, DEA, plating sludges, naphtha, ink, and epoxide polymers and filter cake (A.T. Kearney / SAIC, 1987).

PCB-contaminated materials were deposited into Trench 6, exclusively, and were later removed and placed in the PCB Landfill. The eastern portion of Trench 7 (cells 7A, 7B, and 7C) was later incorporated into the P/S Landfill.

The volume of wastes placed in the Burial Cells Unit is estimated to have exceeded 3,000 tons and is reported to be as large as 40,000 tons. Approximately 16,700 cubic yards of waste materials originally placed in the Burial Cells Unit were excavated to allow for the construction of Pond 23 and were placed into an approximate 1-acre area of the Former RCRA Landfill. Identical detailed lists of waste types and approximate volumes discharged into the trenches are found in the RCRA Facility Assessment (A.T. Kearney / SAIC, 1987) and in site's RCRA Part B

permit of 1988 (see Appendix B of Section 21 - Woodward Clyde Consultants, 1998b). References variably indicate that waste materials present in portions of Trenches 2 and 3, or Trenches 2, 4, and possibly 5, were removed and redeposited in the Former RCRA Landfill (Section 3.5.3, Page 3-25, McClelland Consultants, 1989 and Section 2.2.5.3, Page 2-12, Woodward-Clyde Consultants, 1988b).

The available records indicate that the trenches were used as follows:

Trench 2:	August 1974 to May 1978
Trench 3:	August 1974 to March 1978
Trench 4:	May 1977 to October 1979
Trench 5:	June 1978 to January 1979
Trench 6:	November 1978 until it was incorporated into the PCB Landfill
Trench 7:	January 1979 to August 1979

Between December 1977 and September 1982, shallow disposal wells were drilled and operated in the area within the Burial Cells Unit. A total of 11 wells were drilled directly adjacent to the trenches within the Burial Cells Unit and were used for the purpose of liquid waste disposal. Available information indicates two of these wells (wells 10 and 11) lie between Trenches 4 and 5, and the remaining 9 wells lie between Trenches 3 and 4.

The available records indicate that wastes were injected into the wells during the following timeframes:

Well 1:	January 31, 1978 to May 4, 1978
Well 2:	December 19, 1977 to April 17, 1978
Well 3:	April 18, 1978 to February 20, 1980
Well 4:	April 13, 1978 to August 3, 1978
Well 5:	December 28, 1978 to May 3, 1979
Well 6:	April 12, 1979 to January 10, 1980
Well 7:	May 4, 1979 to February 8, 1980
Well 8:	September 22, 1980 to March 15, 1982
Well 9:	Never placed in service
Well 10:	July 15, 1980 to September 28, 1982
Well 11:	March 9, 1982 to September 28, 1982

Wastes discharged into the wells included unspecified solvents, pesticides, acids, and miscellaneous waste materials (A.T. Kearney / SAIC, 1987). Identical detailed lists of waste types and volumes discharged into each well are found in the previously referenced document and in the site's RCRA Part B permit of 1988 (see Appendix C of Section 21 - Woodward Clyde Consultants, 1998b). The shallow disposal wells consisted of approximate 4-foot diameter borings extending to depths of between 30 to 40 feet. The wells were not cased and Well 9 caved in during installation and was never placed in service. The wells were capped with hexagonal reinforced steel well heads that were one foot high and eight feet in diameter. Each well head was equipped with a vent pipe, a quick disconnect coupling, an inspection hatch and a visual float liquid level indicator to prevent overfilling. The wells were drilled adjacent to the disposal trenches with the intent that the trenches would absorb the liquid wastes. Although waste disposal in the wells was limited due to the low permeability of the strata, more than 1.3 million pounds of material were reported to have been discharged to these wells. The facility experimented with the use of dynamite in one well (unknown which one) to fracture the

surrounding strata, and enhance its permeability. This experiment was reportedly unsuccessful and was not repeated with other wells.

2.2.3.1.3 Former RCRA Landfill and RCRA Canyon

The Former RCRA Landfill is located in a natural canyon (currently referred to as RCRA Canyon, and historically sometimes as West Canyon) on the northwest side of the Site. This area was at one time intended to be lined in preparation to receive RCRA-regulated waste from the McColl Superfund site; however, this never occurred. In late 1983 to early 1984, a small area within the uppermost portion of RCRA Canyon received an estimated 16,700 cubic yards of wastes removed from a portion of the Burial Cells Unit during development of Pond 23. Wastes that were deposited into the Former RCRA Landfill at that time included, but were not limited to, solvents, pesticides, PCBs, oily wastes, and metals. Casmalia Resources constructed Pond 23 to provide localized stormwater capacity after the site underwent a couple of extremely rainy seasons. The RCRA Landfill Closure Plan (Woodward-Clyde Consultants, 1991b) estimates the volume of these deposited wastes to be approximately 16,700 cubic yards. As part of the RCRA Landfill preparations, Casmalia Resources constructed a low permeability compacted clay barrier south of the West Canyon Catch Basin (WCCB – also known as Pond 43), located at the southern terminus of RCRA Canyon. The barrier was keyed into the unweathered claystone. When it became apparent that McColl wastes would not be delivered to the Site, Casmalia Resources excavated the RCRA Canyon wastes, the low-permeability barrier and the WCCB. This excavation reportedly took place during the pond closure period from 1988 through 1990.

RCRA Canyon was also the location of the oil field waste Spreading Areas S-5 and S-6. The north and west slopes of RCRA Canyon received oil field wastes (primarily drilling mud), winery wastes, and spray irrigation of leachate and surface stormwater runoff collected from other portions of the Site (Section 3.5.2.1, Page 3-22, McClelland Consultants, 1989). These liquids may have contained a variety of organic and inorganic constituents. Trucks discharged loads along the northern and western perimeter canyon road and the liquids wastes were allowed to gravity flow down the sideslopes. Casmalia Resources constructed terraces in the canyon sidewalls so the wastes could dry and be turned by dozers working the benches. As noted in the aerial photograph review, liquids accumulated in localized areas of the spreading terraces. Dried wastes were reported to have been periodically removed and used as daily cover in the landfills. Some of the wastes on the sideslopes are still evident, and it is not clear how much of the wastes was moved for daily cover.

2.2.3.1.4 Former Surface Impoundments

Casmalia Resources utilized a total of 43 ponds and 15 evaporation pads to accommodate incoming wastes and to manage on-site stormwater and landfill leachates. General pond information, including the year built, construction notes, surface area and operational capacity is presented in Table 2-3, General Pond Information. The combined surface area of the ponds and pads is approximately 51 to 62 acres, and the operational capacity was in the 196 to 205 million gallon range. Note that two of the site's 43 ponds identified were converted to pads and, as such, are "double counted."

Also presented in Table 2-3 are deposition notations, classes, and surface impoundment (SI) unit designations. The "deposition" notation was used to identify which ponds were direct deposit ponds as opposed to first through fourth generation transfer ponds. Note that only 12 of

the site's ponds directly received off-site wastes (Ponds 14, 15, 18, A-5, A, B, C, D, E, J, P, and T). The "class" designation originated as part of pond closure planning to indicate which ponds had hazardous, nonhazardous and marginally hazardous sludges that had to be solidified prior to being placed in the site landfills. Finally, the "SI unit" designation was the numbering system used to refer to either a single pond, or to a group of ponds that were operated as a unit, accepting transfers from one another. There were 10 SI groupings; the remaining ponds were numbered with only their pond designation. Transfer of liquids to and from ponds in other SI units also occurred as part of site operations. Note that the original SI units as defined in the 1985 RCRA Part B permit application (Woodward-Clyde Consultants, 1985) did not specifically include pads; the pads listed below, however, are within the boundaries of the SI units as outlined in the 1985 RCRA Part B permit.

The 10 SI units included:

- SI-1 (Ponds A-1 through A-4, and A-6; Pad 1A is within the bounds of SI-1 but was never used for waste management);
- SI-2 (Pond A-5);
- SI-3 (Pond 1, and Ponds 15, 17, and 18; this SI unit also encompasses Pad 18 [known as Pad 3A in 1983] and the spray area to the north of Pad 18);
- SI-4 (Pond 2, and Ponds E, J, and L; this SI unit includes the area occupied by Pad 4A);
- SI-5 (Ponds 3, 4, and 9);
- SI-6 (Pond 13);
- SI-7 (Ponds 5, 8, and 10; Pad 7A is within the limits of this SI unit);
- SI-8 (Ponds 11, 12, and 20; Pads 8A, 8B, and 8C are within the bounds of SI-8 although Pads 8B and 8C were reportedly not used for waste management);
- SI-9 (Pond 6; Pads 9A and 9B are also within the limits of SI-9); and
- SI-10 (Ponds 19 and 22; Pads 10A, 10B, 10C, 10E, 10F, and 10G are encompassed by this SI unit's bounds).

As described in the 1985 Part B Permit Application (Woodward-Clyde Consultants, 1985), the remaining ponds were historically referred to as single pond surface impoundments, with the SI unit designation being the same as the pond name (these include: SI Units / Ponds 14, 16, 23, A, B, C, D, M, P, R, S, T and V). The information presented in the historic 1985 RCRA permit application is used as an information source in Table 2-3 to illustrate differences in reported pond usage, size and operational capacity in the available documents. The 1988 RCRA permit application (Woodward Clyde Consultants, 1988b) does not present the pond usage, size and operational capacity information.

The limits of the SI units are indicated on Figure 2-6 along with color shadings indicating the ponds' primary use. As shown in Table 2-4, the notations for the primary pond usages varied among historic documents. The pond usage most fitting considering the ponds' overall operational history is shown on Figure 2-6. Cross hatching is used to indicate ponds that were: direct discharge ponds; those that received wastewaster from the Stringfellow site; and those ponds that received treatment system effluent. Figure 2-6 information is duplicated on Figure 2-7 along with arrows indicating which ponds overflowed or contributed to other ponds. The CSC tabulated the pond designations and pond influent and effluent information (McClelland Consultants, 1989, and A.T. Kearney / SAIC, 1987) along with transfer records for the year 1985 to 1986 that were summarized by others (Canonie, 1989) as presented in Table 2-4. The pond transfer arrows shown on Figure 2-7 are an amalgamation of the influent, effluent and pond transfer information presented in Table 2-4. Note also that the documented pond transfer

information is for only the 1985 and 1986 time period; additional pond transfer activities likely occurred although there is no single source documenting pond transfer activities. It is important to note that the SI unit designations did not govern pond transfer activities and that hazardous liquids likely entered each of the ponds at some point during site operations.

Surface impoundment construction began in 1972, and new impoundments were added or enlarged through 1985. These facilities were used for the receipt, treatment, storage, and evaporative disposal of acid and alkaline wastes, oil field wastes, industrial wastewater, and site stormwater runoff. In addition to the hazardous waste ponds and pads, two waste ponds (Sludges 1 and 2) were used for disposal of non-hazardous wastes such as sewage sludge.

Historically, liquid wastes received at the facility were deposited directly into surface impoundments for treatment or evaporative disposal. Spray evaporation disposal techniques were also used to speed the rate of evaporation. The use of spray evaporation was discontinued in 1985 (Section 3.5.1, Page 3-9, McClelland Consultants, 1989). Liquids disposal to the ponds ceased by 1988, and surface impoundment closure activities were completed from 1988 to 1991. A summary of the pond closure information is presented in Table 2-5. Because of Casmalia Resources' funding constraints during pond closure, closure reports were not prepared for all ponds and pads, although all ponds and pads underwent the same closure process under agency review. Table 2-6 presents a summary of the chemicals detected in the pond and pad sludges prior to closure. Data presented in Table 2-6 were collected to profile pond and pad sludges prior to removal to ensure proper on-site placement. The sludge data in Table 2-6 are independent of the later soil sampling data used to document soil removal activities conducted during subsequent phases of the impoundment closure program. Section 2.2.5.1 provides additional details regarding the different phases of the pond closure process.

A general description of the former surface impoundments at the site is presented below. Detailed information regarding pond transfers is not reiterated below because that information is presented in Table 2-4 and on Figure 2-7. Detailed descriptions of the physical character, nature of contained wastes, and interrelations among the various surface impoundments are presented in the HAR (Canonie Environmental, 1987), RCRA Facility Assessment (A.T. Kearney / SAIC, 1987), Final Environmental Impact Report (EIR) (Table 3.5-1, Page 3-13, McClelland Consultants, 1989), the Preliminary Pond and Pad Characterization document (Environmental Solutions, 1987) and the surface impoundment Closure Certification Reports (Canonie Environmental, 1998b; Brierley and Lyman, 1990a-f, 1991a-l).

2.2.3.1.5 Former Ponds

The surface impoundments that were used at the Site can generally be separated into four categories based on their primary use. The groupings presented below are consistent with those presented in the Final EIR (McClelland Consultants, 1989). Note that the RCRA Facility Assessment (A.T. Kearney / SAIC, 1987) used similar categories for discussion although in some cases single ponds were discussed separate from the larger grouping used in the EIR. Primary differences in the groupings are discussed in the section to follow. The general pond categories include:

- Stormwater runoff control/evaporation ponds;
- Acid/alkaline ponds;
- Oil field waste ponds; and
- Washout ponds.

Stormwater Runoff Control/Evaporation Ponds

The majority of ponds at the Site were used for rainfall and stormwater runoff management to comply with the CRWQCB waste discharge requirement that no liquid be discharged from the site. The ponds used for rainfall and stormwater management and to control pond overflow included Ponds 1, 2, 5, 6, 8, 10, 11, 12, 13, 19, 20, 21 (converted to Pad 10E), 22, 23, A-1, A-2, A-3, A-4, A-5, A-6, and Pond 43 (also known as the WCCB) at the southern end of RCRA Canyon. An unnamed pond in the northeastern portion of RCRA Canyon (which managed seasonal flow from the slope) also was identified as a stormwater pond (A.T. Kearney / SAIC, 1987).

Note that the listing above includes Ponds 6, 19 and 23 which were discussed separately in the RCRA Facility Assessment. Ponds 6 and 19 were unique in that they received landfill runoff and were used for leachate control. Pond 23 was constructed in the Burial Trench Area to provide ocalized runoff control. Although it was originally intended for use as an alternate alkaline pond, it is not clear whether the pond was used for that purpose.

Only a few of the above-listed ponds were specifically designated to directly receive landfill runoff or leachate (Ponds 6 and 19) or bulk liquid waste material (Ponds 23 and A-5). However, because all of the above-listed ponds collected surface runoff from the site, they likely received hazardous constituents, and in June 1987, the RWQCB determined that all surface impoundments were to be treated as containing hazardous materials.

The ponds relied upon the underlying materials to provide vertical containment of the liquids in the ponds with the exception of Pond 22, which was the only pond in this category that had a compacted clay liner. All of the ponds had compacted earthen berms to limit lateral migration of fluids and Casmalia Resources installed a system of overflow pipes that was intended to prevent any given pond from overflowing. Overflow pipe leaks and other breaches were noted during the site's operation. Pond 13, at the southernmost site boundary, was maintained as an emergency overflow pond. In February 1978, Casmalia Resources discharged site liquids down the B-Drainage during a storm that could not be managed on site.

Acid and Alkaline Ponds

Ponds 14 and P directly received both acid and alkaline wastes, and were used for the neutralization treatment of acid and alkaline wastes. Ponds E and J were used for the direct receipt of acid and alkaline liquid wastes. Ponds 15, 17, and 18 were interconnected and used for the storage of acidic and alkaline wastes. Ponds 15, 17, and 18 were plumbed with Pond E such that Pond E could receive overflow from those ponds (A.T. Kearney / SAIC, 1987).

Although Pond 14 was designated as an alkaline pond and Pond P was designated for acidic wastes, alkaline or acidic wastes were stored in either of the ponds depending on operational considerations. Both ponds have compacted clay liners and the ponds were used to hold acid or alkaline wastes for on-site treatment, or to neutralize alkaline or acidic wastewaters and precipitate heavy metals in the ponds themselves. Liquids were discharged to the ponds via PVC pipes in a paved unloading area north of the ponds (A.T. Kearney / SAIC, 1987). The approximate location of the unloading area is shown on Figures 2-6 and 2-7. Note that the unloading areas may have changed over time as observed in historical aerial photographs. At

the time of closure, heavy metal sludges in the ponds were taken to the Heavy Metals Landfill for disposal.

Ponds E and J were sometimes used in lieu of Ponds 14 and P for the storage and treatment of acid and alkaline wastes. Liquid effluent form the Zimpro WAO and the CNS were also routed to Pond E. Ponds E and J also had compacted clay liners.

Ponds 15, 17, and 18 were originally developed to receive wastes from the Stringfellow Acid Pits site. These ponds were used in conjunction with the experimental PACT unit in 1984 to pretreat acidic wastewaters containing metals and to receive effluent from the unit. All three earthen ponds were located in the southwest portion of the facility and were used for storage of acidic wastes. Pond 15 was used for pH adjustment and precipitation of metals; Ponds 17 and 18 were used for overflow and storage. From Pond 15, liquids were pumped to the storage tanks feeding the PACT unit. These ponds were once plumbed with Pond E and used for overflow from acidic and alkaline waste storage in that pond. Pond 18 also received diverted runoff from the PCB Landfill and received effluent from Ponds P and 14 (A.T. Kearney / SAIC, 1987).

Although Pond R is not typically referred to as an acid pond, Pond R received acidic and caustic wastes in 1978 (A.T. Kearney / SAIC, 1987), including hydrocetic acid, formic acid, abronium hydroxide, hydrazine, and unspecific caustics. Pond R otherwise received runoff from the P/S Landfill, and runoff and steam cleaning effluent (before the decontamination tank was installed) from the Maintenance Shed Area.

Oil Field Waste Ponds

Ponds A, B, C, M, S, T, and V received bulk oil field wastes consisting of crude oil, brines, water, and refinery sludges. Ponds A, B, and C directly received oil field wastes and were the oldest ponds at the site. These ponds may also have received solvents (A.T. Kearney / SAIC, 1987). Ponds M, S, T, and V received settled and overflow liquids from Ponds A, B, and C. Additionally, Pond T received petroleum refinery sludges, restaurant kitchen grease, and digested sewage sludge. Ponds B and C were routinely discharged to Pond M by excavating a trench between the ponds and allowing the oil to flow to Pond M. Pond A discharged to Pond S in a similar manner.

Ponds 3, 4, and 9 were grouped in the EIR with the oil field waste ponds because they received overflow from oil field waste Ponds M and V. These three ponds were grouped separate from the oil field waste ponds in the RCRA Facility Assessment as oil field waste "overflow ponds." Based on the operational information available, it appears that these ponds received both oil field waste overflow and liquids from other runoff control ponds. On Figure 2-6, these ponds are indicated as "runoff, evaporation and storage ponds" rather than "oil field waste ponds." The oil field waste ponds designation was used only for those ponds that primarily contained oil field wastes. Ponds 4 and 9 also were capped with oil to control odor emissions in 1985. Liquids in the Ponds 3 and 9 were subsequently treated with hydrogen peroxide and Ponds 3 and 4 had mechanical aeration systems to control sulfurous odors resulting from anaerobic decomposition of the wastes.

Washout Ponds

Ponds D and 16 were used for direct disposal of washout wastewater from oil field waste trucks. Overflow from Pond D was directed to Pond L, which primarily contained washout sludges. These ponds were shallow and thus the size of the ponds appears to change over the years. The washout ponds were operated as evaporation units. Historical records indicate that trucks that used the washout racks were those that had disposed wastes in Ponds A, B, and C (A.T. Kearney / SAIC, 1987).

2.2.3.1.6 Former Non-RCRA Sludge Areas

Sludge Areas 1 and 2 were located along the eastern side of the site and were used to spread dry, non-RCRA wastes such as sewage sludge and restaurant grease-trap sludges. Sludges were discharged from vacuum trucks, then periodically disced to promote aeration and drying. These areas were periodically cleaned out and the dried materials were used for cover landfill material.

2.2.3.1.7 Former Evaporation Pads

A total of 15 evaporation pads were distributed through the Site, including Pads 1A, 4A, 7A, 8A, 8B, 8C, 9A, 9B, 10A, 10B, 10C, 10E, 10F, 10G, and Pad 18. Note that Pads 1A, 8B, and 8C were never permitted or used for waste management due to their proximity to the site boundaries. Nine of the remaining 12 pads were designated as being used for landfill runoff or leachate control (Pad 9A, 9B, 10A, 10B, 10C, 10E, 10F, 10G, and Pad 18); these pads are grouped with the "landfill runoff / leachate control" ponds on Figure 2-6. Pads 4A, 7A, and 8A were simply designated as evaporation pads (and are thus grouped with the "runoff, evaporation and storage" ponds on Figure 2-6); these pads generally received liquids from adjacent ponds (see Table 2-4). The relatively flat pads were designed to increase evaporation by spreading liquids or saturated solids at shallow depths across large surface areas. The pads were constructed of fill removed from other surface impoundments at the site and from fill in the vicinity of the pad. Pad 10E was constructed on top of Pond 21 and no material was removed from that location before Pond 21 was converted to Pad 10E. Although Table 2-3 indicates that the pads were all constructed in approximately 1985, there is evidence (based on the aerial photograph review) of activity on some of the pad locations prior to that time.

As indicated in Section 2.2.5.5, the CSC capped Pads 10C, 10E, 10F, and 10G, and a portion of Pads 10A and 10B as part of the EE/CA Area cap.

2.2.3.1.8 Oil Field Waste Spreading Areas

Six areas at the site were used for the spreading and drying of oil field wastes and drilling mud. The initial Spreading Area (S-1) was located in the areas of Pads 9A and 9B; disposal in this area likely began in 1981 (A.T. Kearney / SAIC, 1987). The other areas (designated S-2 through S-6) were located primarily adjacent to access roads along the northern and western site boundaries, and varied from approximately 1.0 to 2.6 acres in area (Figure 2-4). The spreading areas were road embankments over which oil field wastes (and other wastes in the cases of S-5 and S-6) were sprayed from a truck driving along the road. Although the spreading areas were not engineered units, an effort was made to terrace the embankments so that liquids did not run down the embankment and erode the road. The beginning and the end of the spreading areas were marked with posts so that spreading occurred over a defined area of the

facility. The oil field and other wastes were allowed to dry, and the dried materials were subsequently excavated and used as cover materials for some of the landfills.

Based on the cuts made during pond closure activities, the spreading area materials in Pads 9A and 9B, and Pond 6 were likely excavated at that time (see Appendix W for more information regarding cut and fill resulting from pond closure activities). The spreading areas along the eastern and northern perimeter roads (S-2, S-3, and S-4) are currently under the capped landfills and associated perimeter roads. Residuals and erosion features associated with Spreading Areas 5 and 6 (located in RCRA Canyon) are currently visible.

2.2.3.1.9 Former Drum Burial Unit

According to Casmalia Resources personnel, disposal of drums occurred on an experimental basis in the area of former Pond 19 (Figure 2-4). Drums containing a small quantity of acidic waste were placed in this area between approximately December 1979 and June 1980, prior to construction and operation of the Acids Landfill. Drums in this area were subsequently covered during the construction of the base of Pond 19. These materials were reportedly removed during closure activities for Pond 19.

2.2.3.2 <u>Subsurface Barriers and Extraction Facilities</u>

Subsurface compacted clay barrier walls were installed downgradient of the P/S and PCB landfills in 1980. The P/S barrier includes an extraction point called the Gallery Well. A subsurface barrier also was installed at the base of RCRA Canyon in 1984 and a barrier near Pond 20 was constructed in 1981/1982. As part of early site operations, subsurface clay barriers with extraction facilities also were installed in the B and C Drainages in 1972/1973 and 1982, respectively (Penfield & Smith, 1973; Penfield & Smith, 1982; Woodward Clyde Consultants, 1988). A relatively shallow liquid extraction point, Sump 9B, was constructed in response to evidence of contamination observed during the closure of the former Pad 9B waste pad in 1988 (Harding ESE, 2001g). An additional shallow liquid extraction point, the Road Sump, was installed downgradient of Sump 9B in 1998 to intercept groundwater recharge potentially migrating downgradient from Sump 9B.

Perimeter collection and extraction facilities, including three collection trenches and five extraction wells, were installed at the facility from February to April, 1989 in accordance with the Site's previous Remedial Action Plan (Canonie, 1988; Brierly & Lyman, 1989c,1990h). These features, located along the A, B, and C Drainages, were originally called plume capture and control trenches but are commonly referred to today as the perimeter control trenches (PCTs). Also in accordance with the Site's previous Remedial Action Plan (Canonie, 1988), the extraction trench (or perimeter source control trench - PSCT) was installed downgradient of the landfills in November 1990 (Brierly & Lyman, 1989a; Woodward-Clyde Consultants, 1991).

These various barriers and extraction facilities are further described in the following sections.

2.2.3.2.1 PCB Landfill Clay Barrier

An environmental barrier was constructed along the southwest corner of the PCB Landfill during December 1980 (Woodward Clyde Consultants, 1988a). This barrier was constructed of compacted clay within a trench excavated to approximately 14 feet beneath the ground surface and installed a minimum of four feet into unweathered claystone bedrock (Pacific Materials

Laboratory, 1980). The clay barrier was designed to be a minimum of 10 feet wide and reportedly includes a 6-mil polyethylene sheet lining on its downstream face. No leachate collection system was installed as part of this landfill barrier.

2.2.3.2.2 P/S Landfill Clay Barrier and Gallery Well

Casmalia Resources constructed a clay barrier and extraction point at the toe of the P/S Landfill in 1980. The clay barrier wall is reportedly approximately 200 feet long, 12 feet thick, and up to 50 feet deep (Woodward Clyde Consultants, 1988a). It is believed that the barrier wall extends a minimum of 4 feet into the unweathered claystone formation (Pacific Materials Laboratory, 1981a). The location, alignment, top elevation, and physical properties of this feature were confirmed by an exploratory drilling and sampling program conducted as part of the Remedial Investigation. Details of the P/S Landfill clay barrier investigation are presented in Appendix J of this report. The location of the P/S clay barrier as confirmed during the RI is also depicted in Figures 2-3 and 2-4.

Clay Barrier Construction

The adobe clay barrier was constructed by excavating an east-west ditch along the southern edge of the P/S Landfill. This ditch was approximately 10 feet wide at the bottom to as much as 30 feet wide at the top of the ditch due to sloughing of the soils. The ditch was approximately 200 feet long running along the southern edge of the P/S Landfill and about 30 feet deep. The ditch was dug down approximately 5 feet beneath the blue-gray clay contact (i.e., keyed into the contact) using heavy equipment and was located to be as close to the waste face as possible. According to on-site personnel who participated in the construction of the clay barrier, there were exposed drums at the top of the ditch during construction due to soil sloughing. An access ditch of approximately the same dimensions as the clay barrier ditch was constructed to "T" into the east-west ditch to allow equipment and trucks containing adobe clay access into the east-west ditch. Clay materials and other soils were delivered to the center of the east-west ditch by dump trucks and spread laterally by equipment to fill the ditch, keeping a generally horizontal (i.e., level) surface. The clay barrier was eventually built up to a height of approximately 50 feet and is nominally 8 to 12 feet wide and 200 feet long.

Gallery Well Construction

Casmalia Resources also installed an extraction point directly upgradient of the clay barrier at that time to reduce the liquid levels in the P/S Landfill (Caldwell, *et. al*, 1982). The extraction point, now known as the Gallery Well, was historically known as SP-1 and GCW. The CSC continues to extract liquids from the Gallery Well.

The Gallery Well reportedly extends 5 feet into the unweathered claystone. The base of the Gallery Well is seated in an approximate 4-foot-diameter collection basin filled with gravel. The Gallery Well consists of a 10-inch-diameter polyvinyl chloride (PVC) casing that extends approximately 84 feet from the existing ground surface. The lower 40 feet of casing is perforated to allow liquids to flow into the Gallery Well.

2.2.3.2.3 RCRA Landfill Clay Barrier

An environmental barrier was constructed downgradient of the RCRA Landfill during June to August 1984. This barrier was constructed at the southern end of Pond 43 (or the WCCB), which is located at the southern end of RCRA Canyon. The barrier was constructed of compacted clay within a trench excavated to approximately 30 feet beneath the ground surface,

and was installed a minimum of four feet into unweathered claystone bedrock. The clay barrier is equipped with a leachate collection well, without sump pump, on the upgradient side of the barrier dam approximately at the mid point (Attachment 21-1, Woodward Clyde Consultants, 1988).

2.2.3.2.4 Former Pond 20 Clay Barrier

Pond 20 served as a runoff control pond and was utilized in the evaporation system. It was constructed by the operator's personnel in mid-to-late 1981 and contained a clay core barrier dam located at the pond's southeast corner (Woodward Clyde Consultants, 1988). The clay core is reported to be 15 feet wide and was constructed of compacted material installed a minimum of 5 feet into the unweathered claystone (Pacific Materials Laboratory, 1981b, c). This barrier was sometimes referred to as the A-Drainage clay barrier although it was located more specifically near the limits of former Pond 20.

2.2.3.2.5 Sump 9B

Sump 9B is a gravel-filled collection trench and associated extraction point installed directly downgradient of the P/S Landfill clay barrier and upgradient of the PSCT. Sump 9B is located approximately 200 feet downgradient (south) of the Gallery Well and was constructed during closure of former Pad 9B in response to the observation of contamination below the groundwater table in this location. This feature consists of a circular sump approximately 27 feet deep and 12 feet wide. Extending approximately 100 to 150 feet westward from the sump is a shallow (estimated 8 to 12 feet deep) trench. The sump and trench are filled with gravel to approximately 6 feet below grade and covered with compacted fill material. The trench was not completed into the unweathered claystone. Drilling activities associated with the installation of the Sump 9B companion well in July 2001, confirmed that the sump was excavated and installed down to the unweathered claystone (Harding ESE, 2001e). An extraction point (Well 9B) was installed at the deepest portion of the sump (Harding ESE, 2001g).

As part of USEPA taking over the site in August 1992, the liquids were treated on-site in the Contaminated Liquids Treatment Area and discharged to Pond A-5. Since 1996, as part of the CSC's Interim Liquids Collection/Treatment/Disposal Element of Work, the Sump 9B extracts have either been treated on site or sent off site for disposal or treatment. Currently, fluids removed from the sump are taken off-site for disposal. Extracted volumes from the Sump 9B during the periods of October 1997 – September 1998 and October 1998 – September 1999 were respectively 0.96 million and 0.79 million gallons. Extracted volumes through June of the 1999/2000 time period is 0.62 million gallons.

2.2.3.2.6 Perimeter Source Control Trench

The PSCT is a continuous, approximate 2,650-foot-long and nominally 3-foot-wide gravel-filled collection trench covered with compacted fill material (Brierly & Lyman, 1989a). The PSCT was installed in 1990, on a roughly northwest-to-southeast alignment, across most of the central portion of the site, and is situated in a downgradient position relative to the five inactive landfill areas and the Burial Cells Unit. The PSCT, while crossing most of the central portion of the site, does not extend west of the Casmalia Neutralization System and into the West Canyon Spray Area/RCRA Canyon Area. The PSCT extends to depths of between approximately 13 and 65 feet, depending on the depth at which unweathered claystone bedrock was encountered during construction. The PSCT is designed to intercept subsurface liquids migrating from north

to south across the site. The major components of the PCST include a filter fabric against the native alluvial or fill soils; a permeable gravel backfill; random backfill above the gravel; a low permeability cap to minimize water infiltration; and four collection sumps and associated extraction points. The gravel backfill extends approximately 10 feet above the highest level of groundwater seepage observed during excavation (Drawing D1046-007-2 through D1046-007-7, Brierley & Lyman, 1989a).

The four collection sumps were constructed by excavating pits into unweathered claystone bedrock. Liquids collected in the PSCT flow along the bottom of the trench toward the center of each sump, away from engineered flow divides, which isolate the individual sumps. When liquid levels exceed the level of the flow divides, liquids flow along the base of the trench to the lowest point in the system located at extraction point PSCT-1. Currently, all four sumps have pumps installed and liquids are extracted to maintain liquid action levels mandated by USEPA. Sumps PSCT-1 and PSCT-4 produce the most significant volumes. Annual extraction volumes for PSCT-1 and PSCT-4 are summarized in Table 2-8. Liquids extracted from sumps are currently treated in the granulated activated carbon treatment system and discharged into Pond 18.

2.2.3.2.7 A-Drainage Perimeter Control Trench

A gravel-filled PCT and associated groundwater extraction points (PCT 1-A and extraction points RAP 1A, 2A, and 3A) were installed in 1989 to collect and pump groundwater at the southeast corner of the facility (Brierly & Lyman, 1990h). This PCT was constructed as an additional means for intercepting groundwater flow toward the A-Drainage area. Annual extraction volumes for RAP-1A, -2A, and -3A are summarized in Table 2-8. Extracted liquids are discharged into the RCF Pond.

2.2.3.2.8 B-Drainage Clay Barrier and Perimeter Control Trench

A subsurface clay barrier was installed in 1973 directly downgradient from Pond 13 between the two low hills flanking the head of the B-Drainage (Penfield & Smith, 1973; Woodward Clyde Consultants, 1988). This clay barrier was constructed to restrict groundwater flow in the B-Drainage area. The barrier is reported to be 8 feet wide and approximately 50 feet deep, extending about 4 feet into unweathered claystone. The barrier is equipped with a 1-foot-wide gravel drainage gallery and associated extraction point (extraction point B-5) on its downgradient side to assist in groundwater collection and removal.

A gravel-filled perimeter control trench and associated extraction point (PCT-B and extraction RAP-1B) was installed downgradient from the B-Drainage clay barrier in 1989 (Brierly & Lyman, 1990h). This PCT provides an additional means for intercepting groundwater flow in the B-Drainage area. Annual extraction volumes for RAP-1B are summarized in Table 2-8. Extracted liquids are discharged into the RCF Pond.

2.2.3.2.9 C-Drainage Clay Barrier and Perimeter Control Trench

A subsurface clay-core barrier was constructed between 1981 and 1982 at the southwest corner of the facility, directly down slope (south) of the five A-series ponds formerly located in this area (Loomis, 1982; Penfield & Smith, 1982; Woodward Clyde Consultants, 1988). This structure is over 1,000 feet long and was installed to intercept groundwater migrating southwesterly from the facility in the C-Drainage toward Casmalia Creek. The clay core is approximately 8 feet thick and a maximum of 75 feet deep, extending a minimum of 4 feet into unweathered

claystone bedrock. The clay barrier is equipped with an approximately 1-foot-wide gravel drainage curtain on its upgradient face to assist in the collection of groundwater, which is removed by pumping at extraction point C-5.

A gravel-filled perimeter control trench (PCT-C) was installed in 1989 as a northern extension to the pre-existing clay barrier (Brierly & Lyman, 1990h). This PCT provides additional control of groundwater that may otherwise migrate down the C-Drainage toward Casmalia Creek. Groundwater collected in PCT-C is removed from extraction point RAP-1C. Annual extraction volumes for RAP-1C and C-5 are summarized in Table 2-8. Extracted liquids are discharged into the A-Series Pond.

2.2.3.2.10 Road Sump

The Road Sump is a subsurface collection and containment sump with an extraction pump designed to intercept and capture groundwater recharge potentially migrating downgradient from Sump 9B into an above ground concrete culvert adjacent to the Sump 9B Road. The Road Sump is approximately 10 feet in length and 3 feet wide and completely filled with gabion rock (ICF Kaiser, 1998c). The sump extends 1 foot down into the clay layer to a total depth of approximately 5.5 below ground surface. The Road Sump was constructed and installed with an 8-inch PVC well in November 1998. A well head and extraction pump was later installed in January 1999. Currently, groundwater level in the road sump is measured twice a day to maintain a compliance action level greater or equal to 6 feet below top of casing (ftbtoc).

2.2.3.3 <u>Former Liquid Waste Treatment Systems</u>

Historical site treatment units and systems included the following:

- Casmalia Neutralization System (CNS) used to treat acidic and alkaline liquids;
- Hydrogen peroxide treatment system to control odors near Pond 3;
- Oil recovery and treatment system tanks operated north of Pond M;
- Zimpro wet air oxidation (WAO) unit used to oxidize organic liquids; and
- Zimpro PACT unit, which was a temporary pilot-scale treatment system.

2.2.3.3.1 Casmalia Neutralization System

The Casmalia Neutralization System was operated at the Site between 1986 and 1989 for the purpose of neutralizing and treating acid, alkaline, and heavy metal wastewater streams delivered to the facility. The initial operation trials were completed on acidic and corrosive waste streams containing hexavalent chromium. The facility was a covered, open-air structure on a concrete slab with a surrounding 2-foot high concrete containment structure. The concrete slab and containment were coated with a corrosion resistant coating and the slab contained three sumps, which were pumped out as needed.

The CNS consisted of six 10,600-gallon wastewater storage tanks, a 10,600-gallon lime storage tank, two 500-gallon feed tanks, three reactor vessels, a 4,880-gallon effluent diversion tank, a 4,880-gallon reducing agent storage tank, and two 20,000-gallon effluent storage tanks. Three of the 10,600-gallon storage tanks were used to accept acid wastewater and three were used to accept alkaline wastewater delivered from trucks from the unloading area. The facility also housed a centrifuge to concentrate and remove solids. Solids were place in roll-off bins and

then transported to the Heavy Metals Landfill for disposal. Liquids from the centrifuge were conveyed to Pond E.

As further discussed in Section 2.2.5.3, the CSC decommissioned and dismantled the CNS in 1997.

2.2.3.3.2 Hydrogen Peroxide Treatment System

The hydrogen peroxide treatment system was located north of Pond 3. This unit was installed and started operation in August 1985 to treat odor problems resulting from the generation of sulfurous gases from Ponds M, 4, and 9. The system included an oil separator tank and two polypropylene treated water storage tanks, as well as two stainless steel hydrogen peroxide feedstock tanks. Liquid was first passed through the oil separator tank, which utilized excelsior for filter material. Liquid then entered PVC pipes where hydrogen peroxide was injected, and flowed to two tanks located at the north bank of Pond 3. The treated water was retained in the tanks for approximately one hour; it then flowed to Pond 3 or was pumped to Pond 10. Both Ponds 3 and 10 were aerated to remove any remaining sulfides.

The oil separation tank was a horizontal steel tank of approximately 5,000-gallon capacity. The treated water tanks each had approximately 8,000-gallon capacity; they were set directly on the ground surface.

2.2.3.3.3 Oil Recovery and Treatment System

The waste oil treatment facility was located between Ponds B and M and became active in the early 1970s. The system consisted of one horizontal 240-barrel (bbl) oil storage/treatment tank, one vertical 200-bbl storage/treatment tank, and one vertical 1,000-bbl oil storage/treatment tank west of Pond S and south of Pond B. The horizontal tank was located on the dike of Pond B, topographically about 30 feet above the vertical tanks, which were at the base of the Pond B dike. All three tanks were steel, closed-roof construction and were set on the ground with no secondary containment.

Originally, the horizontal tank was used for the first phase separation and then oil was sent to the 200-bbl vertical tank for heat treatment. From there it was pumped to and stored in the 1,000-bbl tank for use in dust control and sale as spec oil.

2.2.3.3.4 Zimpro Wet Air Oxidation System

A Zimpro Wet Air Oxidation (WAO) unit was operated at the Site between March 1983 and April 1987. The unit was located within the existing groundwater treatment area (Figure 2-4). The WAO unit was designed to oxidize liquid wastes at high temperatures in order to produce carbon dioxide, water, and other oxidized products. Treated wastes included cyanide/sulfide and organic wastes. Resulting vapors were directed to a WAO vapor treatment system for scrubbing. The unit was ordered closed by the County Santa Barbara in 1987, due to excessive air emissions (Section 3.5.6, Page 3-26, McClelland Consultants, 1989).

The WAO unit was inside a roofed structure, on concrete with diking around it. Four 15,000-gallon waste storage tanks were located west of the unit on concrete pads in a gravel area surrounded by an earthen berm. The other two 15,000-gallon tanks were located north of the building on concrete pads in a gravel area on top of the embankment immediately north of the

WAO unit. These two tanks were later moved adjacent to the four tanks east of the WAO unit and a concrete containment area was constructed (creating what was later referred to as the "six-pack tanks".)

2.2.3.3.5 Zimpro Powder-Activated Carbon Unit

The powered activated carbon treatment (PACT) unit was a temporary pilot-scale treatment unit brought to the site to specifically to treat wastes from Stringfellow Acid Pits. The system was operated by Zimpro under a joint venture arrangement with Casmalia Resources. The system was located near the WAO treatment building and operated from June 1984 through December 1894. All components of the system were removed from the site at that time.

The design flow for the unit was 5,000 gpd and the process was operated 24 hours per day. The PACT equipment consisted of two 21,000-gallon influent storage tanks, one 2,450-gallon aeration tank, one 3,000-gallon clarifier, and one 500-gallon sludge storage tank, as well as other conventional activated sludge equipment (e.g., blowers and pumps). Process solids from the unit went to the Solvent/Pesticides Landfill, and liquids were disposed of in Pond E.

2.2.4 Existing Surface Impoundments

Past CRWQCB Waste Discharge Requirements dictated zero discharge from the Site, and since 1987, all stormwater runoff and treated groundwater was contained within the site boundary. In November 1999, a National Pollution Discharge Elimination System (NPDES) permit for the Site was adopted by the CRWQCB (Permit No. CA0049972, Order No. 99-034) allowing periodic discharge of treated surface waters if certain on-site conditions were met. A General NPDES permit was also adopted by the CRWQCB for the Site in 2003 (Permit No. CA 0049972, Order No. R3-2004-0124), which allowed periodic off-site discharge of clean stormwater runoff draining from capped areas of the site, including the P/S Landfill cap and the EE/CA cap areas.

There currently exist six unlined surface impoundments within the site boundary to store all surface runoff water and treated liquids. These facilities are briefly described below.

2.2.4.1 <u>Stormwater Runoff Collection Ponds</u>

A total of four surface water runoff collection ponds are currently present at the Site. Three of these ponds are located along the south-central and southwestern site boundary, and are identified as the Runoff Containment Facility (or RCF Pond), Pond 13, and the A-Series Pond (Figure 2-3). The RCF Pond lies in the area once occupied by portions of former Ponds 2, 3, 4, 8, 9, 10, and 11. The A-Series pond lies in the area once occupied by portions of former Ponds A-1, A-2, A-3, A-4, and A-6. Pond 13 is the most southerly (downgradient) of the original stormwater runoff containment ponds and is still utilized for its original purpose of runoff control.

The remaining surface water runoff collection pond comprises a small unlined collection basin constructed during 2003 by the CSC in a portion of the Central Drainage Area (Figure 2-3). Clean stormwater runoff from the P/S Landfill cap and EE/CA cap is directed via drainage swales into this basin, and a pipeline from the basin allows impounded stormwater to be drained directly into the RCF Pond or the upper reaches of the B-Drainage for off-site discharge, bypassing uncapped areas of the site. This pipeline is equipped with valves and flowmeters to control the location and rate of discharge. Discharges from this pond are permitted under the

General NPDES permit. Test discharges from this basin were conducted during the 2005-2006 rain year.

2.2.4.2 Treated Liquids Impoundments

Two treated liquid impoundments are currently present at the Site. These ponds are located on the southwestern portion of the site, and are identified as Pond A-5 and Pond 18 (Figure 2-3). The locations of these two holding ponds largely correspond with those of former ponds of the same designation. Treated liquids extracted from Sump 9B and the Gallery Well were once discharged to Pond A-5, although Pond A-5 does not currently receive any liquids. Pond 18 currently receives treated effluent from the PSCT granulated activated, carbon-treatment system.

2.2.5 Closure Activities and Response Actions, and Ongoing Monitoring

Previous closure activities/response actions completed by Casmalia Resources during site operations included closure of the former ponds and pads and removal of two fuel tanks at the site. Additional response actions include CNS decommissioning completed by the CSC and ongoing capture and treatment of liquids from the various active extraction points within the site, including PSCT-1, PSCT-2, and PSCT-4, the Gallery Well, Sump 9B, and the extraction points associated with the several clay barriers, collection galleries, and PCTs installed along the downgradient site margins. Liquids management activities at the Site were initiated by Casmalia Resources and were continued by USEPA during the emergency response period until the CSC began work at the Site. Finally, the CSC constructed RCRA-equivalent caps over four of the five existing site landfills.

2.2.5.1 Surface Impoundment Closure Activities

Closure of existing surface impoundments was implemented in accordance with CAO No. 89-60, issued by the CRWQCB. The overall objective of closure operations was to remove hazardous constituents once present in the former surface impoundments to background or other cleanup levels approved by the CRWQCB. The proposed removal activities and confirmatory sampling and analysis procedures associated with impoundment closure are described in the Existing Surface Impoundment Closure and Post-Closure Plan (Canonie Environmental, 1989b).

Surface impoundment closure was undertaken in three stages: removal, bottom sludge removal, and contaminated subgrade removal. Removed fluids were either evaporated or solidified for disposal into on-site landfill areas. Bottom sludges were similarly solidified and disposed of. Contaminated subgrade materials encountered during closure activities were relocated to on-site landfill areas for disposal.

The excavation of subgrade materials continued until laboratory testing of confirmatory soil samples indicated that pre-approved analyte-specific background concentrations or Toxicity Characteristic Leaching Procedure (TCLP)-based (TCLP-based) Target Cleanup Levels (TCLs) had been achieved, or until further excavation became impracticable.

Procedures in the Existing Surface Impoundments Closure and Post-Closure Plan (Canonie, 1989a) called for a minimum of four randomly located samples to be collected from the floor of all 58 former ponds/pads and chemically analyzed to document subgrade conditions. Chemical

analyses were conducted for all initial confirmation sampling locations, and included the following:

- Volatile organic compounds (VOCs) – USEPA Method 8240;
- Semi-volatile organic compounds (SVOCs) – USEPA Method 8270;
- Organochlorine pesticides and PCBs – USEPA Method 8080;
- Chlorinated herbicides – USEPA Method 8150;
- California Assessment Method (CAM) metals – California Title 22;
- Chromium VI – USEPA Methods 7195, 7196, 7197, or 7198;
- Hydrogen cyanide – USEPA SW-846 Section 7.3.3.2;
- Hydrogen sulfide – USEPA SW-846 Section 7.3.4.2;
- Organic lead – CAM metals, California Title 22;
- pH – USEPA Method 9045; and
- Conductivity – USEPA Method 9050.

Testing for chromium VI and organic lead were conducted only if samples were found to have total chromium or total inorganic lead concentrations in excess of approved background-based TCLs.

After initial closure verification testing was completed to the satisfaction of investigators, all pond/pad excavations were examined by representatives of the CRWQCB and the Department of Health Services, the predecessor agency to the Department of Toxic Substances Control. As described in the available Closure Certification Reports, agency representatives required the collection of multiple additional verification samples for further analytical testing from each former impoundment area.

In addition to sampling and testing former surface impoundment subgrade materials, approximately 84 samples were randomly collected for similar chemical testing from areas where impoundment fluid transfer pipelines and culverts had been removed. These samples were also compared to TCLs to confirm acceptable closure along former pipeline and culvert alignments. Agency-required verification sampling was performed in excavation sidewall areas, beneath entry and exit pipelines and culverts, as well as throughout the floor areas of impoundment excavation areas. It is estimated that in excess of 780 soil samples, or 11 to 12 samples per acre of impoundment area, were collected and chemically analyzed during the impoundment closure process to document closure conditions.

Target cleanup levels were not met in all closure samples, and Casmalia Resources submitted closure reports for only 16 ponds and 3 pads as follows:

- Pond 4 (Canonie Environmental, 1989b);
- Ponds 1, 3, 5, 6 (eastern 2/3), 8, 10, 11, 12, 15, 17, 20, A-1, A-2, A-3, and A-4 (Brierley and Lyman, 1991a, 1991b, 1990b, 1991c, 1990c, 1990d, 1991d through 1991l, respectively); and
- Pads 8A, 8B, and 8C (Brierley and Lyman, 1990b, c, and d, respectively).

Casmalia Resources was negotiating with the agencies to secure the RCRA permits needed to keep the Site in operation during the pond closure period. When it became apparent that the Site would not remain in operation, Casmalia Resources stopped preparing closure certification reports although the closure work was completed (including removing and stabilizing sludges, excavating subgrade soils, and collecting confirmation and verification samples). According to

the RWQCB, the data generated from many of the ponds was not transmitted to the agencies even though the agencies participated in the pond closure walkthroughs at the Site. None of the surface impoundment certification reports were formally approved by the RWQCB.

Of the 19 closure reports reviewed, chemical testing results indicate that some of the impoundment areas had inorganic constituents at concentrations slightly in excess of TCLs at the time of closure. Ponds with concentrations exceeding TCLs included Ponds 1 (selenium), 4 (barium), 10 (barium, copper, and lead), 17 (nickel), and Pads 8A (barium) and 8C (nickel). Additional excavation was reportedly performed at Ponds 10 and 17; concern regarding undermining the adjacent NTU roadway was cited as the reason not to proceed with further excavation at Pond 1. Reported barium concentrations at Pond 10 were 3.0 parts per million (ppm) over the TCL of 140 ppm for this compound. Because initial samples collected at the base of Pad 8C prior to excavation were found to have acceptable concentrations, no further excavation was performed. The closure report for Pond A-1 indicated that diesel fuel contamination (from a nearby fuel pump) was left in place and that further excavation was not completed due to the proximity of NTU Road.

Contamination may have been left in place in other ponds where closure reports are not available. To assess the closure status of the ponds without closure reports, the CSC relies on available correspondence during the period October 1989 and February 1991 between site investigators, Casmalia Resources staff, and the CRWQCB. Based on the available information, it appears that minor organic contamination may have been left in the southeastern corner of Pond 2 and that contamination in the northeast corner of Pond 13 was present at the time of pond closure. Additionally, oil seeps were observed in Ponds B, C, and J and it is not clear what resolution, if any, was made regarding these areas. Casmalia Resources personnel speculated that oil noted in these areas was naturally occurring.

Closure conditions and recommendations for the majority of former surface impoundments were presented to the CRWQCB in a letter from the investigators overseeing the closure activities (Brierley & Lyman, 1990a). Closure conditions as described in this letter were based on analytical results for random confirmatory sampling, agency-required verification sampling, and the findings of field inspections by agency personnel. Closure conditions were also based on the assumption that the impoundment areas would be subsequently covered as part of a landfill closure or become the subsurface of a new lined RCRA Landfill. The 1990 closure recommendations made for each former pond and pad fell into one of three categories, as follows:

- Recommended for closure: applied to all former surface impoundment areas where constituent concentrations were found to be below approved TCLs, or in limited cases where TCLs were only slightly exceeded, or where logistical considerations precluded further excavation;
- Closure process incomplete: applied to former surface impoundments where iterative soil excavation, sampling, and analytical testing activities were still underway when closure activities at the Site ceased. Available information regarding conditions within individual impoundments under this classification indicate that constituent concentrations in excess of TCLs may have been left in place locally; and
- Recommended for closure as a landfill: applied to former impoundments where excavation of contaminated soils to TCLs was judged to be impracticable.

Based on available information, it appears that 40 out of the 58 former surface impoundments, or approximately 70% of the total number, were *recommended for closure*. Four entire impoundments (Pad 9A, Pad 9B, Pond R, and Pond 23) and limited portions of two others (the western one-third of Pond 6 and the southern berm area of Pond 19) were *recommended for closure as landfills*. Impoundments recommended for closure as landfills are restricted to the area lying north of the PSCT. They either overlie or are in close proximity to known existing contamination sources, including the Burial Cells Unit and the toe area of the P/S Landfill. The closure status of former surface impoundments as categorized above is shown on Figure 2-8. The CSC compared topographic maps for years 1987 to 1998 to quantify excavations made during pond closure activities described above. An oblique view of the site, depicting cut and fill between these years, is shown on Figure 2-9.

2.2.5.2 Fuel Tank Removals

Casmalia Resources removed two fuel tanks from the Site. One was an underground diesel fuel tank associated with the Zimpro WAO system and located outside in the southeast corner of the current Operations Building (which formerly housed the WAO equipment). The approximate 500-gallon tank was reportedly removed when the WAO system was dismantled in the late 1980s. Casmalia Resources personnel reported that the tank removal was conducted under Santa Barbara County Fire Department regulations and oversight. Although Casmalia Resources submitted a closure report for this tank removal, the CSC has not been able to locate the associated documentation.

The second tank Casmalia Resources removed from the Site was an aboveground tank located in the transportation yard south of the A-Series Pond. The tank was on a concrete containment structure with curbing on the south side of NTU Road, and the pump and fuel dispenser were located north on the south side of NTU Road adjacent to Pond A-1. The tank was removed from the Site in the late 1980s and no closure documentation was generated. As described in the section above, diesel fuel contamination was noted during pond closure activities in the subsurface soils south of Pond A-1.

2.2.5.3 CNS Dismantling

The CSC dismantled and decontaminated the tanks, process equipment, and piping associated with the CNS facility in November 1997. These activities included emptying residual sludges from the tanks and draining other tanks, valves, and piping. After the tanks, equipment, and piping were removed, the CSC cleaned and pressure washed the remaining concrete containment structure and collected wipe samples from the concrete. The results of the wipe samples indicated low concentrations of metals. Results of investigations conducted in support of ths decommissioning and dismantling process are presented in the Final CNS Demolition Report (ICF Kaiser, 1998d).

2.2.5.4 Subsurface Site Liquids Management

There are several extraction features at the Site including the following: Gallery Well, Sump 9B, PSCT, the PCTs, and the Road Sump. Liquids have been extracted from these features since they were each installed, although the method for treating and/or disposing of these liquids has changed over time.

All of the extracted liquids from the Gallery Well and Sump 9B were sent off-site for disposal until 1995, when the USEPA built and operated a pilot biological/powdered activated carbon treatment (biological/PACT) system for these liquids. The pilot treatment unit treated a portion of the Gallery Well and Sump 9B liquids; the remainder of these liquids was disposed of off-site. The treated effluent from the biological/PACT system was sent to Pond A-5. The CSC dismantled the system in 1998 and began shipping all Gallery Well and Sump 9B liquids off-site for disposal. In 2000, the CSC built and operated the synthetic resin Ameripure Treatment System (ATS) to treat liquids from the Sump 9B and PSCT extraction facilities. The granulated activated carbon canisters continued to be used as polishing units for the system effluent prior to discharge in Pond 18. The ATS was designed to treat a commingled stream of PSCT and Sump 9B liquids at a ratio not to exceed 90% PSCT and 10% Sump 9B. The remaining volume extracted from Sump 9B and all of the Gallery Well extracted liquids continued to be shipped off-site for treatment and disposal. Operation of the ATS treatment system was discontinued in 2003. Currently all extracted liquids from the Sump 9B and Gallery Well facilities are shipped off-site for treatment and disposal. PSCT liquids continued to be treated through the granulated activated carbon adsorption system. PSCT liquids have been treated using the granulated activated carbon adsorption system, and its effluent was sent to Pond 18 since the system was installed by the USEPA in 1993.

Groundwater extraction has been ongoing since 1980 when the owner/operator constructed the Gallery Well and began operating it as a groundwater collection facility. The owner/operator subsequently constructed additional groundwater collection facilities consisting of PCT-A, PCT-B, and PCT-C in 1989 and the PSCT in 1990. Operation and documentation responsibilities for the groundwater collection facilities were transferred from the owner/operator to the USEPA in 1992. Responsibility for operation and maintenance of these facilities was transferred to the CSC after the USEPA ceased emergency response operations at the Site in 1996. Table 2-7 summarizes the historical sequence of contaminated liquids control facility construction, extraction, treatment, and/or disposal, and Table 2-8 summarizes liquid extraction volumes from these features

The groundwater collection facilities are operated to maintain water levels at or below specific criteria elevations. Criteria water level elevations are described by water level depths measured from a datum such as top of casing of the collection facility and have been historically referred to as "action levels." Tables 2-9 through 2-12 describe the historical chronology of contaminated liquids control facility action levels for the Gallery Well, Sump 9B, PSCT, and PCTs, respectively. Daily liquid level measurements document compliance with the specific action levels established for each pertinent extraction point. Compliance with the established action levels is summarized by the CSC in quarterly operations reports to the USEPA.

2.2.5.4.1 Gallery Well and Other Extraction Feature Action Levels

The Gallery Well was originally approximately 50-feet deep; however, the well casing has been extended twice to accommodate changes to the surrounding surface grade. Approximately 30 feet of casing were added 1981/1982 when the landfill was again expanded, and more recently, an additional 4 feet of casing were added in 1999 when the CSC placed additional fill on the P/S Landfill buttress as part of the P/S Landfill cap construction.

The CSC has been extracting liquids from the Gallery Well since they took over operations at the Site in 1996. In accordance with the Consent Decree (USEPA, 1997), the initial action level that the CSC maintained was 30 feet below top of casing (BTOC). When the Gallery Well casing was

extended 4 feet in 1999, the CSC maintained a measured liquid action-level equivalent to 34 feet BTOC, as was agreed to by the USEPA. Following discussions with the USEPA in 2000, the action level for the Gallery Well was subsequently lowered in a series of step changes beginning in October 2000. Between October 2000 and July 2001, the CSC lowered the liquid level in the Gallery Well in a series of steps to the current action level of 63 feet BTOC.

At that same time, the CSC also lowered action levels in several other extraction features. The action level in Sump 9B was lowered from a Consent Decree level of 6 feet BTOC to 15 feet BTOC. The action level in PSCT-1 was lowered from a Consent Decree level of 22 feet BTOC to 45 feet BTOC. The action level in PSCT-4 was lowered from 43 feet BTOC to 51 feet BTOC. At that time, the CSC also began pumping liquids from PSCT-2 and PSCT-3, setting action levels of 52 and 55 feet BTOC, respectively.

2.2.5.5 Landfill Closure Activities

While the majority of landfill areas remain intact, wastes once deposited in the former RCRA Landfill and the former Drum Burial Area were removed and redeposited in one of the existing inactive landfill areas. With the exception of the PCB Landfill, the inactive site landfills have been capped.
Landfill closure activities have included the following actions:

- Removal of wastes from former RCRA Landfill sometime between April 1989 and early 1990;
- Removal of wastes from the former Drum Burial Area between approximately December 1979 and 1980;
- Capping of the P/S Landfill in 1999; and
- Capping of the Heavy Metals Landfill, Caustic/Cyanides Landfill, Acids Landfill, and interstitials areas between these landfills (EE/CA Area Cap) during 2001-2002.

2.2.5.5.1 Site Spills and Seeps

Since the CSC began work at the Site in 1996, there have been some notable groundwater seeps and liquid spills resulting from extracted liquid pipeline breaks. These have included:

- A contaminated seep known as the "9B Road Seep" that was located immediately west of the road traveling from PSCT1 to Sump 9B approximately 35 feet north of PSCT1. There have been no surface liquids in this seep location for the last six years, however, when the seep did exist, elevated contaminant concentrations were noted;
- A seep on the southern face of the Pond A-5 dike. That particular seep is greatly diminished since the water level in Pond A-5 has been lowered. That seep has been sampled a number of times during the last nine years, and the water quality is similar to or better than the Pond A-5 liquids (which have all been below MCLs);
- A seep in the southeastern dike of Pond 18. Although Pond 18 is on the western side of the road to the treatment area, the seep is on the eastern side of the road. That seep also has been periodically sampled over the past nine years, and the results do not indicate significant contamination. The seep could be Pond 18 liquids or uncontaminated perched water;
- An April 22, 2001, Gallery Well break;
- An October 14, 2001, PSCT pipeline break; and

- An April 11, 2005, approximate 85-gallon spill of RIPZ-8 purge water from mobile polytank container.

In addition to the more significant leaks noted above, the CSC recorded a number of minor line leaks and subsequent liquid releases from 1996 to 2002 along the Sump 9B, Gallery Well, and PSCT conveyance pipeline corridors. These minor releases were generally areas where the glued PVC pipe joints developed a drip and the cleanup was limited to removal of a small amount of soil. In these cases, the impacted soil was over-excavated and any observed areas of contaminated soil were removed and disposed of. The PVC extracted liquid pipelines for the Sump 9B, Gallery Well, and PSCT wells were replaced with welded HDPE pipe in 2000, 2001, and 2002 respectively. There have been no reported leaks or spills from any of the pipelines since the PVC pipe was replaced.

The CSC performs daily pipeline inspections and notes any leaks or other conditions requiring maintenance on inspection forms. Leak repairs and non-routine activities (such as sampling seeps) are noted in the project log book maintained at the Site. The USEPA on-site personnel have access to the daily log book and inspection forms.

2.2.6 Groundwater and Surface Water Monitoring

Site groundwater and surface water quality has been monitored since 1992; the monitoring consisted of measuring water levels and collecting water quality samples for laboratory analysis. The CSC initiated a routine monitoring program pursuant to the Consent Decree SOW in 1997. The monitoring is part of the Routine Groundwater Monitoring Element of Work (RGMEW).

The RGMEW monitoring has been conducted on an approximately semiannual basis. The semiannual monitoring frequency was implemented to evaluate seasonal effects on water level and water quality data.

Prior to 1992, the most comprehensive studies that included groundwater level and quality information were the Hydrogeologic Site Characterization and Evaluation Report (HSCER), (Woodward-Clyde Consultants, 1988a) and the Hydrogeologic Site Investigation Report (HSIR) (Woodward-Clyde Consultants and Canonie Environmental, 1989).

The location of current groundwater monitoring wells and piezometers is shown on Figure E-1 in Appendix E.

2.2.6.1 Groundwater Level Monitoring

Water level monitoring data have been collected and reported as part of water quality monitoring activities conducted at the Site. Prior to 1992, the water quality monitoring activities included:

- Hydrogeologic Assessment Report (HAR) (Canonie Environmental, 1987). Approximately 75 wells and piezometers were installed prior to 1987. The report presented an initial evaluation of the Site groundwater flow system;
- Hydrogeologic Site Characterization and Evaluation Report (HSCER), (Woodward-Clyde Consultants, 1988a). Approximately 90 additional wells or piezometers were installed across the Site. Water levels were collected in 1987 at approximately 150 wells and

piezometers. Water level data was used to create water level elevation maps and analyze the horizontal and vertical groundwater flow system;

- Groundwater Level Assessment Report, (Woodward-Clyde Consultants, 1988c). A round of groundwater level measurement similar to those collected during the HSCER were collected and presented in a supplementary report; and
- Hydrogeologic Site Investigation Report (HSIR), (Woodward-Clyde Consultants and Canonie Environmental, 1989). Water levels were collected in March 1989 at approximately 124 wells and piezometers. The number of available wells was reduced due to well destruction associated with pond closure and site modernization activities. Data were used to create water level elevation maps and to analyze the horizontal and vertical groundwater flow system.

Beginning in 1997, semiannual sampling events have been conducted and the CSC issues Semiannual Monitoring Reports as part of the RGMEW. The semiannual monitoring and reporting activities include quarterly water level monitoring rounds, continuous water level monitoring from selected wells, and water level monitoring from liquid control features.

Since 1997, semiannual groundwater level measurements have been conducted by the CSC in parallel with groundwater quality monitoring events. The dates of these semiannual monitoring events are identified in the following section.

2.2.6.2 Groundwater Quality Monitoring

Water quality monitoring data has been collected and reported as part of water quality monitoring activities conducted at the Site. Prior to 1992, the water quality monitoring activities included, but were not limited to:

- HSCER, 1988 – 150 wells sampled and analyzed for VOCs, SVOCs, chlorinated pesticides and polychlorinated biphenyls (PCBs), inorganic compounds and other targeted parameters. Addressed lateral and vertical extent of contamination;
- Casmalia Resources – 13 wells monitored quarterly for VOCs, total dissolved solids (TDS), nitrate, bromide, chloride, nickel, selenium, chromium, total organic carbon (TOC), dissolved organic carbon (DOC), and total organic halogens (TOX); and
- HSIR, 1989 – 118 wells sampled and analyzed for VOCs, TDS, nitrate, bromide, chloride, nickel, selenium, chromium, TOC, DOC, and TOX. 78 wells analyzed for Appendix IX constituents listed in 40 CFR 264, and other selected parameters including those stipulated by the RWQCB.

Beginning in 1992, the USEPA conducted several targeted sampling events. The USEPA data included:

- USEPA, 1992 through 1994 – 23 wells sampled and analyzed for VOCs, SVOCs, TOC, TOX, TDS, metals, and general water quality parameters. Data collected over this period were summarized in a Technical Memorandum (CH2MHill, 1996). Sampled wells were primarily at the site boundaries and within the off-site drainages;
- USEPA, 1994 – PSCT-2, PSCT-3, and PSCT-4, and SW-17 sampled and analyzed for VOCs, SVOCs, TOX, purgeable organic halides (POX), DOC, chlorinated pesticides and PCBs, organophosphorus pesticides, para-chlorobenzene sulfonic acid, metals, TDS, and general water quality parameters. The results were summarized in the National

Enforcement Investigations Center (NEIC) report dated April 19, 1995 (USEPA, 1995); and

- USEPA, 1996 – 8 wells sampled and analyzed for VOCs and SVOCs. Sampled wells included RAP-1A, RAP-1B, RAP-3A, C5, A2B, B3M, RP-64B, and RP-100A (USEPA, 1996a).

Beginning in 1997, the CSC, as part of the RGMEW, conducted 22 semiannual sampling events. Sampling occurred in accordance with RGMEW Field Sampling Plan (ICF Kaiser, 1997) or subsequent revised versions of the Field Sampling Plan (Harding Lawson Associates, 2000b and Harding ESE, 2001a). Samples were analyzed for chemicals of potential concern (COPCs) that include 206 compounds identified in the 40 CFR 264 Appendix IX – Groundwater Monitoring list and 23 additional unlisted compounds detected in samples collected from the on-site liquid control features. The compounds hydrazine, perchlorate, and nitrosodiphenylamine (NDMA) were added to the analyte list for select wells starting in November 1999.

In January 2009 the CSC requested a number of modifications to the RGMEW scope of work, which have now been incorporated into the ongoing groundwater monitoring program at the Site (MACTEC, 2009a).

Semiannual (SA) sampling events completed by the CSC are summarized below.

- SA Event No. 1 – September 1997 (ICF Kaiser, 1998a);
- SA Event No. 2 – Sampled June 1998 (ICF Kaiser, 1998b);
- SA Event No. 3 – Sampled October 1998 (ICF Kaiser, 1999);
- SA Event No. 4 – Sampled April 1999 (Harding Lawson Associates, 1999);
- SA Event No. 5 – Sampled November/December 1999 (Harding Lawson Associates, 2000b);
- SA Event No. 6 – Sampled July 2000 (Harding ESE, 2001i);
- SA Event No. 7 – Sampled May 2001(Harding ESE, 2001j);
- SA Event No. 8 – Sampled October 2001 (Harding ESE, 2002);
- SA Event No. 9 – Sampled April 2002 (MACTEC, 2003a);
- SA Event No. 10 – Sampled October 2002 (MACTEC, 2003b);
- SA Event No. 11 – Sampled May 2003 (combined with previous report dated October 2003);
- SA Event No. 12 – Sampled October 2003 (MACTEC, 2004);
- SA Event No. 13 – Sampled April 2004 (MACTEC, 2005);
- SA Event No. 14 – RI Groundwater Sampling Event No. 1 – Sampled October 2004 through March 3, 2005 (combined with previous report dated July 22, 2005);
- SA Event No. 15 – RI Groundwater Sampling Event No. 2 – Sampled March 21 through May 12, 2005 (MACTEC, 2006a);
- SA Event No. 16 – Sampled November 2005 (combined with previous report dated December 12, 2005) (MACTEC 2006a);
- SA Event No. 17 – Sampled April/May, 2006 (MACTEC, 2007);
- SA Event No. 18 – Sampled October 2006 (combined with previous report dated September 20, 2007);
- SA Event No. 19 – Sampled April 2007 (MACTEC, 2008);
- SA Event No. 20 – Sampled March 2008 (MACTEC, 2008);
- SA Event No.21 - Sampled April/May 2008 (MACTEC, 2009b); and,
- SA Event No.22 - Sampled October /November 2008 (MACTEC, 2009b).

2.2.6.3 Current Status of Site Monitoring Well Network

Many of the groundwater monitoring wells, piezometers, and other borings and casings drilled and installed by Casmalia Resources in the 1970s and 1980s were in poor condition or no longer in existence when the CSC began the RGMEW in 1997. Many of the wells and piezometers were in poor condition or no longer in existence due to their age and damage or destruction as a result of remediation activities performed by Casmalia Resources in the 1980s. Beginning in 1999, the CSC performed the following activities in response to an August 3, 1999 letter by EPA:

- Located and inspected all onsite wells
- Performed field investigation activities to assess identify and condition of wells
- Repaired wells, as necessary, to meet minimum standards agreed to by EPA and CSC
- Resurveyed the position and elevation of all wells

The CSC submitted a series of draft well inventory reports with updated information and to respond to EPA comments on the Draft Report and follow-up revised reports. The CSC submitted a Final Well Inventory Report (MACTEC, 2006b) that was approved by EPA. The Final Well Inventory Report is a stand-alone report that documents the condition and construction of the monitoring well network, not including the wells and piezometers installed as part of the RI. The report includes tables that document the history and status of each well, well construction details, boring and well logs, and a comprehensive map of all site wells. Additional history and details of the monitoring well inspection and repair program are provided in the Final Well Inventory Report.

The CSC submitted to the USEPA in December 2002, a Draft Well Inventory Report (MACTEC, 2002b). The report compiled information requested by the USEPA associated with chemical quality sampling points and water level monitoring locations that are currently, or have historically been, part of the RGMEW at the Site. The Draft Well Inventory Report presented field activities and research conducted to resolve the USEPA's questions and issues associated with the monitoring well network at the Site.

The objectives of the well survey efforts were to confirm that the physical data associated with chemical quality monitoring wells and water level monitoring points in the network were valid and representative of conditions at the site, and to comply with USEPA Data Quality Objectives (USEPA, 2006). The CH2MHill *Well Inventory Report* (CH2MHill, 1997) discussed work performed in 1994 for the USEPA at the Site. The CH2MHill report discusses a well inventory conducted in November and December 1994. A subsequent well inventory was conducted by ICF Kaiser Engineers in 1997 (ICF Kaiser, 1999: Appendix Table A-1, Summary of Well Construction Details). A comparison of the data collected during these two earlier well inventories identified well maintenance deficiencies and differences in the well construction details, locations, and measured depths of several wells. Based on these data, the USEPA requested an additional well inventory be conducted to resolve discrepancies and identify needed repairs, and then repair wells as needed.

To resolve the discrepancies and collect the required data to prepare a complete well inventory for the Site, a field survey team consisting of MACTEC and CH2MHill representatives collectively physically located wells at the Site, documented the condition of the wells, measured the total depth of the wells, and compared the information to the site-related documents.

The initial survey was completed in 1999, and a follow-up survey was completed in 2000. Disparities encountered between these well surveys were identified in the RI/FS Work Plan (Appendix K – Tables 1 – 6 and Figure K-1), and recommendations were presented for implementation as part of the RI field activities.

2.2.6.4 Surface Water Quality Monitoring

Surface-water quality monitoring data has been collected and reported as part of water quality monitoring activities conducted at the Site. Prior to 1992, the surface water quality monitoring activities included:

- HSCER, 1988 – Standing surface water features within a 1-mile radius of the Site were sampled and analyzed for VOCs, SVOCs, chlorinated pesticides and PCBs, inorganic compounds, and other targeted parameters; and
- HSIR, 1989 – Standing surface water features within a 1-mile radius of the Site were sampled and analyzed for VOCs, TDS, nitrate, bromide, chloride, nickel, selenium, chromium, TOC, DOC, and TOX. Water samples were analyzed for Appendix IX constituents listed in 40 CFR 264, and other selected parameters including those stipulated by the RWQCB.

Beginning in 1997, the CSC, as part of the RGMEW, conducted and reported 20 semiannual sampling events. Sampling occurred in accordance with RGMEW Field Sampling Plan (ICF Kaiser, 1997) or subsequent revised versions of the Field Sampling Plan (Harding Lawson Associates, 2000b and Harding ESE, 2001a). Surface water samples collected from the existing stormwater runoff collection ponds and treated liquid impoundments were analyzed for COPCs that include 206 compounds identified in the 40 CFR 264 Appendix IX – Groundwater Monitoring list and 23 additional unlisted compounds detected in samples collected from the on-site liquid control features. Since 1997, the semiannual surface water quality monitoring activities were conducted in parallel with the groundwater level and groundwater quality monitoring events summarized above.

2.2.6.5 Surface Water Level Monitoring

Surface water level monitoring data was collected and reported as part of site operation and maintenance activities. Beginning in October 1992, water level monitoring of the five ponds has been generally conducted on a daily basis as part of site maintenance and operation activities. The CSC took over site responsibilities on September 26, 1996. Site operation and maintenance information, including pond water levels collected since September 26, 1996, have been reported in Quarterly Progress Reports and submitted quarterly to the USEPA.

2.3 Previous Site Investigations

This section provides an overview regarding the overall purpose, objectives, and scope of prior and ongoing investigations conducted at the Site. Data from investigations completed at the Site provide the basis for the current understanding of the extent of soil and groundwater contamination at the Site. The scope of investigations proposed in the RI/FS Work Plan was based on the findings of investigations completed up to that point (i.e., 2004). Summary information for investigations completed since that time is briefly discussed below for completeness.

Three primary historical site characterization investigations have been conducted at the Site:

- Hydrogeologic Assessment Report (HAR) (Canonie Environmental, 1987);
- Hydrogeologic Site Characterization and Evaluation Report (HSCER) (Woodward-Clyde Consultants, 1988a); and
- Hydrogeologic Site Investigation Report (HSIR) (Woodward-Clyde Consultants and Canonie Environmental, 1989).

Each of these investigations was performed in response to agency requests for information about the Site. Following is a brief description of each of these investigations. In addition, there have been several subsequent investigations and studies that were considered in the developing the hydrogeologic conceptual site model and other aspects of the RI/FS Work Plan.

2.3.1 Pre-EPA Assessment Activities

The HAR was the first comprehensive study to describe conditions at the Site in relation to the waste disposal activities. The scope of the HAR focused on the southern portion of the site, where early waste disposal activities took place. The investigation was conducted in May 1987, and a report was submitted to the CRWQCB in November 1987 (Canonie Environmental, 1987).

The basic focus of the HAR was to assess the hydrogeology of the Site in terms of the presence or potential for migration of wastes and/or waste constituents through the subsurface. The HAR also provided a comprehensive characterization of the wastes in each of the existing surface impoundments, identified the owners of the Site, described the climatology of the Site, described the nature of surface waters at the Site, and described the relationship of the Site to off-site wells and regional water resources.

2.3.1.1 <u>Hydrogeologic Site Characterization and Evaluation Report</u>

The HSCER provided further characterization of the Site and substantial additional information on the hydrogeological conditions and on the nature and extent of soil and groundwater contamination. Investigations for the HSCER were conducted by Woodward-Clyde Consultants over the period spanning May 1986 through November 1987. The work conducted helped to further delineate the nature and extent of soil contamination at and surrounding the Site, and to further refine the site hydrogeologic model that was in development at the time.

2.3.1.2 <u>Hydrogeologic Site Investigation Report</u>

The HSIR provided an update to the Hydrogeologic Summary Report (HSR) (Woodward-Clyde Consultants and Canonie Environmental, 1988). The HSIR primarily utilized and summarized information from all the previous investigations and work conducted at the Site up to that point. However, the HSIR also included results of additional water and soil investigations conducted for CAO 88-145 (revised CAO 88-76). The HSIR represents the most comprehensive compilation of technical information available at that time regarding hydrogeologic conditions and the nature and extent of soil and groundwater contamination at the Site.
As part of the HSIR, background concentrations for selected organic chemicals and inorganic metals were developed. From the background sampling data, Threshold Limit Values (TLVs) were developed, and the background levels established were evaluated to determine appropriate concentrations for each chemical constituent for use in conjunction with closure of the surface impoundments, and for characterization of the lateral and vertical extent of

contaminated soil at the Site. These concentrations were/are referred to as Target Closure Levels (TCLs).

2.3.1.3 Brierley & Lyman Studies

Brierley & Lyman Inc. published Final Construction Drawings for the PCTs and PSCT (Brierley & Lyman, 1989a and 1991b). The packages were provided to fulfill the requirements of the CRWQCB CAO 88-61 Task i. The packages included drawings with specifications noted for required construction materials.

In addition to the construction drawings, Brierley & Lyman submitted a report titled "Preliminary Evaluation of the Effectiveness of the Plume Capture Collection Trenches" (Brierley & Lyman, 1989c), and a follow-up report titled "Performance Evaluation of the Effectiveness of the Plume Capture Collection Trenches" (Brierley & Lyman, 1990h). The purpose of the reports was to describe the hydrogeologic impact of each of the collection systems from the time they were constructed through November 1989. The reports concluded that operation of the PCT-B and PCT-C collection systems was creating localized depressions in the groundwater table in the vicinity of the extraction sumps, and they recommended continued operation with no operational changes.

Brierley & Lyman also prepared and submitted Closure Certification Reports for some of the former ponds and pads at the Site (Brierly & Lyman, 1990b-g, 1991a-l). The agencies never formally approved these reports although agency personnel were present for the various site inspections and walkthroughs associated with pond closure.

Brierley & Lyman also conducted sampling in the West Canyon (includes both the RCRA Canyon area and West Canyon Spray area designated in the RI/FS Work Plan) to evaluate the nature and extent of contamination due to waste disposal practices (Brierley & Lyman, 1990i).

2.3.2 EPA Response Activities

2.3.2.1 Final USEPA Report on 1995 Stormwater Discharge

The USEPA released stormwater from the Site to Casmalia Creek in 1995. The USEPA (in conjunction with the USFWS and USEPA's Emergency Response Team) prepared a report detailing their analysis of environmental impacts associated with the off-site stormwater discharge. The assessments included impacts on the environment, impacts to known special-status species, and impacts to the receiving surface water (i.e., Casmalia Creek).

The final USEPA report on the 1995 stormwater discharge (USEPA, 1996b) concluded that the 1995 stormwater discharge had no adverse impacts on either the special-status species or the creek habitat.

2.3.3 CSC Site Work Activities

2.3.3.1 Part 1 EE/CA Work Plan Studies

The CSC submitted a series of Engineering Evaluation/Cost Analysis (EE/CA) Work Plans to the USEPA.

The Part 1 EE/CA Work Plan included a conceptual site model for hydrogeology and for risk assessment at the Site, a plan for evaluating existing data available for the Site, a plan for performing additional site investigations as necessary to characterize the Site for purposes of the baseline risk assessment, and a plan for performing an engineering evaluation and cost analysis of response actions for the EE/CA Area.

The draft Part 1 EE/CA Work Plan was the basis for the CSC's work in preparing an EE/CA Report (URS, 2000) that ultimately became the EE/CA Action Memorandum (prepared by USEPA in April, 2001). The EE/CA Report proposed capping three landfills and the interstitial areas between these landfills. EE/CA Area cap construction was completed by the CSC during 2001-2002.

2.3.3.2 Summer 2000 Field Activities

Between May and September 2000, at the direction of the USEPA, the CSC installed and developed seven new chemical water quality wells and 25 new piezometers at the Site. These monitoring points were installed to provide data in areas of the Site where the USEPA had identified potential data gaps. The results of these activities were submitted to the USEPA in the report titled *Well and Piezometer As-Built Report, Summer 2000 Field Activities* (Harding ESE, 2001h).

The data use objectives associated with this work fell generally into two categories: chemical quality wells and piezometers. Chemical quality wells were installed to provide chemical water quality and hydraulic head data to augment the existing groundwater quality monitoring network in monitoring the distribution of contaminants at the Site and to further refine the Hydrogeologic Conceptual Site Model (HCSM). Piezometers were installed to provide both lateral and vertical hydraulic head data to augment the existing groundwater water level monitoring network.

2.3.3.3 Interim Liquids Investigations

In 2001, the CSC conducted specific site investigations in response to USEPA requests, as first outlined in a March 24, 2000, letter from the USEPA to the CSC. The CSC and the USEPA agreed to a scope of work that addressed the USEPA's March 24 demands in an October 2000 Interim Liquids Agreement signed by both parties. Three separate work plans were prepared and investigations were completed to address the areas of concern noted below:

- The potential "Low Area" within the P/S Landfill;
- The Gallery Well construction and status, including the location of the clay barrier; and
- The construction of Sump 9B and potential dense non-aqueous phase liquids (DNAPLs) in the immediate vicinity.

The work plans described activities that were to be conducted to evaluate the specific concerns at the areas noted above (Harding ESE, 2001c, 2001d, and 2001e, respectively). The field work was completed in early 2001 and reports were submitted to the USEPA in July and October 2001.

2.3.3.3.1 P/S Landfill Potential "Low Area" Investigation

The objective of this investigation was to evaluate the presence of a potential "low area" in the excavated sub-grade of the P/S Landfill and the potential presence of DNAPLs that may be associated with that potential low area.

Under the agreement reached with USEPA in the Interim Liquids Agreement (ILA), CSC was to determine if a low area existed, and to identify whether DNAPL is present in the potential low area. The CSC proposed to accomplish this by conducting cone penetrometer testing (CPT) and installing piezometers using direct-push technology (DPT) in the P/S Landfill in the vicinity of the potential low area. The results of this investigation were submitted to the USEPA in the *Report of Findings, Pesticide Solvent Landfill Low Area and Gallery Well/Clay Barrier Investigations* dated July 31, 2001 (Harding ESE, 2001f).

2.3.3.3.2 Gallery Well and Clay Barrier Investigations

The Gallery Well and clay barrier investigation work plan described five separate activities as listed under the "Gallery Well." The work objectives and included activities are listed below:

- Delineating the location and extent of the clay barrier that is located downgradient of the Gallery Well;
- Confirming the depth and, as necessary, cleaning out any materials in the Gallery Well;
- Installing a dedicated pump to remove DNAPL from the Gallery Well;
- Installing additional piezometers along the upgradient side of the existing clay barrier; and
- Lowering the liquid action-level in the Gallery Well.

The results of these activities were included in the *Report of Findings, Pesticide Solvent Landfill Low Area and Gallery Well/Clay Barrier Investigations* dated July 31, 2001 (Harding ESE, 2001f). While the CSC completed the activities specified in the ILA work plans, the exact location, depth, and alignment of the P/S Landfill clay barrier were not adequately determined by this work. Additional work conducted as part of the RI field investigations confirmed the location, alignment, and character of the P/S clay barrier. The findings of this additional work are presented in Appendix J of this report .

2.3.3.3.3 Sump 9B Investigation

The Sump 9B investigation included:

- Lowering the liquid action-level in Sump 9B;
- Installing a companion well adjacent to Sump 9B; and
- Monitoring for the presence of DNAPL in the area immediately adjacent to Sump 9B.

The results of the Sump 9B investigation were submitted to the USEPA in the *Summary Report for the Sump 9B Work* dated October 4, 2001 (Harding ESE, 2001g).

2.3.3.4 <u>P/S Landfill Cap Design</u>

The *Revised Final Pesticides Solvent Landfill Cap Design Report (Final Design Report)* was prepared by Foster Wheeler Environmental Corporation and GeoSyntec Consultants for the CSC to present the proposed design of the cap and modified buttress for the P/S Landfill at the site (Foster Wheeler/GeoSyntec, 1999).

2.3.3.5 P/S Landfill Cap Construction Completion Report

The CSC submitted a draft *Pesticides/Solvent Construction Completion Report* (Foster Wheeler, 2002) to the USEPA to comply with the requirements of the Casmalia Consent Decree and Statement of Work. The Construction Completion Report provided USEPA certifications that the P/S Landfill cap was constructed in conformance with the approved specifications and provided USEPA as-built drawings for the completed construction work. The report also includes field and laboratory test data collected to document conformance with the plans and specifications. The USEPA provided comments on the draft P/S Landfill As Built Report that were addressed by the CSC and incorporated in an addendum to the As Built Report (Foster Wheeler, 2002) the CSC submitted to the USEPA.

2.3.3.6 EE/CA Area Landfill Cap Design

The *Revised Final EE/CA Area Cap Design Report (Final Design Report)* was prepared by Foster Wheeler Environmental Corporation and GeoSyntec Consultants for the CSC to present the proposed design of the caps and buttresses for the Heavy Metals/Sludges (M/S), Caustics/Cyanides (C/C) and Acids Landfills and adjacent interstitial areas (collectively referred to as the EE/CA Area Cap) at the site (Foster Wheeler/GeoSyntec, 2001). This revised design report was submitted to address modifications to the original final design when waste was unexpectedly encountered at shallow depths on the C/C Landfill. The design for this landfill was modified as discussed in Design Change Request – DCR07 that was submitted to the EPA in 2001 (Foster Wheeler/GeoSyntec, 2001).

2.3.3.7 EE/CA Area Cap Construction Completion and As-Built Report

The EE/CA Area Cap Construction Completion and As-Built Report (Ford, 2003) was submitted by Ford Construction Company which includes an appendix entitled Construction Quality Assurance Report, EE/CA Area Closure (Vector, 2003) by Vector Engineering to inform the CSC and USEPA that the EE/CA Area Cap had been constructed and completed in general accordance with the plans and specifications.

2.3.3.8 Groundwater Data Summary Report

The CSC prepared and submitted the *Groundwater Data Summary Report* (Harding Lawson Associates, 2000a), pursuant to the requirements of the Consent Decree Statement of Work. The report was prepared in response to USEPA concerns associated with the CSC's groundwater monitoring program, including QA/QC, data presentation and data interpretation. The USEPA provided the CSC with their comments on the Groundwater Data Summary Report in their letter dated August 8, 2001 (USEPA, 2001).

The objective of this report was to provide a summary of groundwater quality and hydrogeologic data collected at the Site by various parties since 1992. The data summarized in the report consisted of available groundwater chemical data, groundwater water-level data, and hydrologic data collected at the Site between 1992 and 2000. The then most recent chemical data considered in the report were collected in November/December 1999 as part of the 5th semiannual sampling event conducted under the RGMEW.

2.3.3.9 Landfill Cap Surface Water Runoff Collection Pond Design and Completion Report

As described in Section 2.2.4.1, the CSC constructed a small unlined collection basin in a portion of the Central Drainage Area in 2003 to collect stormwater from the P/S Landfill and EE/CA Area caps (Figure 2-3) (Boston Pacific, 2003).

2.3.3.10 Pond Water Management

The CSC implemented a pond water management program following the 1997/98 El Nino winter to reduce and maintain pond water volume in the five onsite ponds at safe levels so that they would not overtop their berms. The pond water management program is documented in a Pond Water Management Plan (CSC, 2001) and follow-up revisions, through Revision 8 (CSC, 2001, 2003a, 2003b, 2004).

The CSC removed water through a combination of spray irrigation, spray misting, and truck road dust control watering from 1998 through 2006. This irrigation and misting included:

- Spray irrigation of RCF water to the former Pond M and Pond T area from 1988 to 2004
- Spray misting of A-Series pond water on its northeastern bank from 2001 to 2004
- Spray misting of Pond 18 water on it's northern bank from 1998 to 2006

The CSC used additional RCF pond water for construction of the P/S Landfill cap in 1999 and construction of the EE/CA Area cap in 2001 and 2002.

The CSC initially discharged clean stormwater from the P/S Landfill and EE/CA Area caps offsite to the B-Drainage in spring 2006 to test the small unlined collection basin in the Central Drainage Area that collects clean stormwater runoff (Figure 2-3). The CSC began routine offsite discharge of clean cap stormwater during the 2008/09 winter under the General NPDES permit.

2.3.3.11 Biological Species Surveys

The USEPA requested that a biological species and habitat survey (BSHS) be conducted at the Site in conjunction with the CSC's work on the EE/CA Area cap design/construction.

The findings of the surveys are summarized in the following reports:

- *Updated Sensitive Species Report* (Dames and Moore, November, 2000) – This report was submitted by the CSC to the RWQCB as required by the NPDES Discharge Permit #99-034;
- *Draft Biological Species and Habitat Survey Report* (Hunt & Associates, 2001) – This report was submitted by the CSC to the USEPA. Surveys were also conducted in 2002 for the tiger salamander (Hunt & Associates, 2002); and
- *Updated Biological Species and Habitat Report* (Harding ESE, 2001b) – This report was submitted to the USEPA as required under the EE/CA cap construction work plan. Surveys were conducted in 2002 for plants and birds as well (MACTEC, 2002a).

2.3.4 RI/FS Activities

In compliance with the terms of the Consent Decree, the CSC prepared additional work plans and reports related directly to the RI/FS process. These documents include the following:

- Remedial Investigation/Feasibility Study Work Plan (CSC, 2004);
- Interim Progress Report (CSC, 2005a);
- NAPL Memorandum (CSC, 2006);
- Phase II and III RI Sampling Plans (CSC, 2005b and 2007); and
- Tier 2 Ecological Risk Assessment Sampling and Analysis Plan (CSC, 2009).

These documents are briefly described below.

2.3.4.1 RI/FS Work Plan

The final RI/FS Work Plan was developed during the period 2001 through 2004 through a series of iterative draft documents and related agency comments. The CSC prepared and submitted three draft versions of the Work Plan prior to submittal of the final document in June 2004. The final Work Plan document incorporates the issues identified in agency comments on prior draft versions, and presents the scope of work and investigative methods completed during performance of RI field investigations and the risk assessment process.

In developing the Work Plan, a series of historical aerial photograph reviews were conducted to assess how Site activities and conditions evolved over time. These studies helped provide a better understanding of historical Site features, activities, and conditions, and were used to help define the nature of work planned for the RI. Under the direction of the USEPA and the CSC, a series of four aerial photograph studies were conducted between 2001 and 2003 by ERI, a USEPA contractor. These studies included the following:

- Review of six site-wide photographs from the period 1974 to 1989 (ERI, 2001)
- Review of eight site-wide photographs from the period 1977 to 1988 (ERI, 2003a)
- Review of eleven site-wide photographs from the period 1970 to 1992 (ERI, 2003b); and
- Review of selected photographs of the Burial Trenched Area, P/S Landfill barrier, and pre-site drainages (ERI, 2003c)

The RI/FS Work Plan identified areas of the Site and surrounding area where historical information indicates similar prior settings, uses, operations, facilities, and/or waste management and disposal practices. These areas of common history are identified as "study areas" in the Work Plan. The specific investigations conducted during RI field activities within each individual study area were developed based on an understanding of the historical uses of these areas.

The following study areas were identified in the evaluation.

2.3.4.1.1 Soil and Sediment Study Areas

- Capped Landfills;
- PCB Landfill;
- RCRA Canyon Area;
- West Canyon Spray Area;
- Burial Trench Area;
- Central Drainage Area;
- Liquids Treatment Area;

- Maintenance Shed Area;
- Administration Building Area;
- Roadways;
- Remaining On-Site Areas;
- Off-Site Areas;
- Stormwater Ponds; and
- Treated Liquids Impoundments.

2.3.4.1.2 Surface Water and Groundwater Study Areas

- Stormwater Ponds;
- Treated Liquids Impoundments;
- Northern Groundwater Area;
- Southern Groundwater Area; and
- Off-Site Surface Water and Groundwater.

These study areas are referenced throughout this report and are depicted in Figure 2-11.

2.3.4.2 Interim Progress Report

Upon completion of the majority of RI field sampling activities identified in the Work Plan, the CSC prepared an Interim Progress Report (IPR), which was submitted to the USEPA in February 2005. A series of IPR addenda and follow-up errata were subsequently prepared and submitted to the USEPA in response to agency comments received on the initial IRP document, and subsequent addendum and errata submittals. These addendum and errata submittals primarily provided additional data summary and presentation formats to assist USEPA review of the Phase I investigation findings. IPR addendum and errata submittals are briefly summarized in the following sections:

2.3.4.2.1 IPR Addenda

- **IPR Addendum #1** (May 30, 2005) – Provided follow-up and additional information in response to the USEPA's comments (dated April 15, 2005) on the initial February 2005 IPR submittal, including revisions to text, tables and or figures relating to IPR appendices A, B, and R;
- **IPR Addendum #2** (June 20, 2005) – Provided some additional tables and figures, summarizing RI activities and findings relating to IPR Appendix B, as requested by an email from the USEPA dated June 9, 2005;
- **IPR Addendum #3** (July 8, 2005) – Provided tables summarizing site-wide RI statistics data in a different format, as requested by an email from the USEPA dated June 27, 2005;
- **IPR Addendum #4** (July 19, 2005) – Provided the same reformatted statistics tables of RI data (this time sorted by Study Area), as requested in an email from the USEPA dated July 12, 2005;
- **IPR Addendum #5** (August 12, 2005) – Provided boxplots and bubble diagrams of select organic and inorganic constituents detected in soil during the RI program, as requested in an email from the USEPA dated July 19, 2005; and
- **IPR Addendum #6** (November 30, 2005) – Responded to USEPA's remaining comments (dated September 26, 2005) on the draft IPR and subsequent addenda.

2.3.4.2.2 IPR Errata

- **IPR Errata #1** (April 14, 2006) – Prepared in response to USEPA comments dated September 26, 2005 on the IPR and subsequent IPR Addenda submittals. Provided revisions to select text sections, figures and tables and appendices of the IPR document, including portions of the main IPR report as well as portions of IPR appendices A, B, C, F, G, M, and R;
- **IPR Errata #2** (April 21, 2006) – Provided additional revisions to select figures for Appendix G – Groundwater Chemistry, that were originally issued in IPR Errata #1;
- **IPR Errata #3** (June 2, 2006) – Prepared in response to USEPA' s conditional approval letter for IPR, dated May 6, 2006. Presented a revised Appendix H and responses to final agency comments relevant to text, tables and /or figures contained in IPR appendices B, E, F, G, J, M, N, O, and R; and
- **IPR Errata #4** (June 28, 2006) – Prepared in response to USEPA's September 26, 2005 comments on the IPR, and provided an updated version of IPR Appendix N – Offsite Well Survey.

Final comments on the IPR and addenda were received in a letter from the USEPA dated March 6, 2006. The Final IPR, which incorporated responses to these final USEPA comments, was then prepared and submitted to the USEPA on April 14, 2006. The USEPA subsequently conditionally approved the IPR in a letter dated May 9, 2006.

2.3.4.3 NAPL Memorandum

The CSC summarized the findings of the NAPL and other groundwater investigations in the *Interim Progress Report* (IPR) submitted to EPA in February 2005. In their September 26, 2005, comments on the IPR, the USEPA requested that the CSC synthesize the available data specifically regarding the presence of DNAPLs in the Lower Hydrostratigraphic Unit (LHSU), assess the potential for migration of site DNAPL, and document that information in a memorandum (CSC, 2006). The DNAPL memorandum was prepared to address EPA's comments and summarized all of the data collected at the Site for both DNAPL and light nonaqueous-phase liquid (LNAPL).

The memorandum served as the "first cut" at assembling the information needed to: (1) describe the presence of site NAPLs and (2) assess remedial alternatives for site groundwater (which will be discussed in more detail in the future FS).

2.3.4.4 Phase II and III RI Sampling Plans

In response to USEPA comments on the IPR and related addenda, the CSC prepared and submitted two Phase II sampling plans, including the Final Fall 2005 Phase II RI Sampling Plan, dated November 18, 2005, and the Final Spring 2006 Phase II Sampling Plan, dated May 25, 2006. The Phase II Sampling Plans outlined additional field data collection activities designed to address agency comments. Planned Phase II field activities encompassed the collection of additional soil, soil vapor, and groundwater and surface water samples from specific areas of the Site where Phase I findings indicated the need for further characterization. In response to the USEPA comments on requested interim data summary information resulting from Phase II investigations, the CSC prepared and submitted the Revised Final Phase III Sampling Plan, dated March 27, 2007 The Phase III Sampling Plan outlined a limited subsurface investigation

program to be completed in a specific portion of the Site where Phase II investigations had not adequately delineated impacts initially encountered during Phase I investigations..

2.3.4.5 Tier 2 Ecological Risk Assessment Sampling and Analysis Plan

After completing and reporting the Tier 1 ERA in the draft RI Report (CSC, 2008), the CSC prepared the *Next Steps for Ecological Risk Assessment* memorandum (Next Steps Memo; ARCADIS, 2008) and accompanying Tier 2 ERA Sampling and Analysis Plan (CSC, 2009). These documents outlined additional studies and methods to further evaluate pathways, receptors, and chemicals of interest (COIs) driving risk at the Site in order to refine risk estimates, and were designed to make the ecological risk assessment more Site-specific and less generic. Details of the methods are provided in the Tier 2 ERA Sampling and Analysis Plan (CSC, 2009).

2.4 References

ARCADIS. 2008. *Memorandum: Next Steps for Ecological Risk Assessment (Revised).* November.

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